Memoirs
of
The Torrey Botanical Club

Vol. 21, No. 2 May 26, 1960

Editor
MURRAY F. BUELL

A STUDY OF RUSSULA TYPES

By
L. R. HESLER
Department of Botany, The University of Tennessee
Knoxville, Tennessee

Published for the Club by
THE SEEMAN PRINTERY
Durham, N. C.

A STUDY OF RUSSULA TYPES

L. R. HESSLER

Department of Botany, The University of Tennessee
Knoxville, Tennessee

CONTENTS

	PAGE
Introduction	1
The cuticle of the pileus	1
Ornamentation of the spores	2
Pleurocystidia and cheilocystidia	2
Explanation of plates and figures	2
Types studied	2
Literature cited	24
Illustrations	26

A STUDY OF RUSSULA TYPES[1]

L. R. Hesler

In my effort better to understand the species of *Russula,* a study of certain North American types has been undertaken. Special attention has been given in these studies to the structure of the pileus cuticle, and to the ornamentation of the spores.

Studies of this kind have been reported by Singer, Burlingham, Schaeffer, Smith, and others (see Literature Cited), but in papers published to date, illustrations of the cuticle and spores have been limited or lacking.

In this paper is presented a series of illustrations of the spores and of the pileus cuticle-structures of one hundred fifty-nine species of *Russula* types and authentic collections.

Acknowledgment is made to the National Science Foundation for a grant supporting these studies, and to the following institutions for the loan of types: Harvard University, New York Botanical Garden, New York State Museum, The University of Florida, and The University of Michigan. The original drawings were made by the author. The plates were then prepared by Mrs. Romance F. Carrier, a former graduate student in botany at The University of Tennessee.

The Cuticle of the Pileus

The taxonomic value of the cuticle-structure in the genus *Russula* lies in its diversity. A tangential section through the pileus reveals that the cuticle-composition is of one of two general types: the cuticle may consist of an undifferentiated layer of hyphae which are repent, or ascendant (as in Figs. 179, 259, and others); or it may be differentiated into an outer layer,—the epicutis, and a subjacent zone,—the hypodermium (subcutis of some authors). There may be still a third zone, or layer, the subhypodermium, which is usually a conspicuous zone of parallel to interwoven hyphae disposed tangentially (Fig. 186a). The hypodermium is either pseudoparenchymatous (Figs. 195, 196, and others) or prosenchymatous (Fig. 186a, and many others) in structure and composition.

The composition of the epicutis is likewise diverse. It is composed of more or less erect hyphal elements which may be either septate (as in Figs. 185, 203) or non-septate (many instances). The free ends of the epicuticular hyphae may be either rounded or acute. These erect elements may be scattered over the surface, or they may be closely parallel, and thus may

[1] Contributions from the Botanical Laboratory, The University of Tennessee, N. Ser. No. 210.

form an hymeniform layer, or turf-like palisade. In a majority of the types studied, pilocystidia stand among the epicuticular hyphae (Figs. 160-165 and many others). These bodies are more or less clavate, broader than the hyphae, and usually with granular to banded contents.

Ornamentation of the Spores

In addition to spore form and size and the color of spore-deposits, the nature of spore-wall ornamentation is of specific taxonomic value. To study these ornamentations, spores from deposits, when available, or from the lamellae, are mounted in Melzer's reagent. In such mounts the ornamentations (warts, lines, bands) are stained dark-blue to blackish.

In the genus, spore ornamentations vary from minute punctations to conspicuous warts. In the spores of some species the warts are very short (0.1 μ or less), or in others they may be long (1.0-2.0 μ or more in height). The warts may be slender and acute, or broad and blunt. At times the warts are connected by fine lines, which in some species form a net-work, or the warts may be catenulate. In many species rather broad bands or ridges are present, and, with or without fine lines, may be disposed to form a reticulum.

Pleurocystidia and Cheilocystidia

Included in this treatise are several *Russula* types on which no studies up to this time have been reported. For these species, observations on pleurocystidia and cheilocystidia are recorded. For information on the cystidia of other *Russula* types, the reader is referred to the literature.

Explanation of Plates and Figures

In all drawings, the elements of the epicutis are reproduced at a magnification of 500; the spore-drawings are at a magnification of 1500. All structures were studied under an oil-immersion lens at a magnification of 1150.

Types Studied

In the descriptive legends, the *Russula* species studied are arranged alphabetically, and citation for each is given to the orginial description. Reference is also made to the accompanying figures which illustrate the structures. Finally, where Singer has published studies on the type, his publication is cited. Although most of the studies reported below are based on type-collections, some exceptions are noted.

R. admirabilis Beards. & Burl., Mycologia 31: 492. 1939. *Spores* (Fig. 6) 7.5-10 × 5.7-7 μ, warts 0.4-0.8 μ high, isolated or catenulate, at times with connecting fine lines. *Epicutis* (Fig. 271) composed of loosely interwoven hyphae, some with acute apices; some erect, others repent. *Pilocystidia* granular to banded, at times septate. (Singer 1957: 261.)

R. affinis Burl., Mycologia 16: 22. 1924. *Spores* (Fig. 2) 7-8 × 6-7 μ, warts 0.1 μ or less in height, isolated or with a few fine lines. *Epicutis* (Fig. 185) composed of tufts of pale brownish, septate, somewhat constricted hyphae, the apices more or less acute; with scattered, fusoid, granular to banded *pilocystidia*. (Singer 1939: 323.)

R. alachuana Murr., Mycologia 30: 362. 1943. *Spores* (Fig. 23) 7-9 × 6.5-8 μ, warts 0.4-1.0 μ high, ridges and a few fine lines forming a reticulum. *Epicutis* (Fig. 184) composed of constricted hyphae, each with a basal cell, the hyphae tending to form a palisade. *Pilocystidia* none. (Singer 1957: 182.)

R. albella Pk., New York State Mus. Ann. Rept. 50: 101. 1897. *Spores* (Fig. 69) 8-9 × 6.5-7.5 μ, warts 0.5-0.8 μ high, with some bands and fine lines. *Epicutis* (Fig. 186) at first composed of loosely interwoven, slender hyphae and clavate *pilocystidia*, some of which are buried, others protruding; in age, much of the original epicutis sloughs away, and is replaced by erect, constricted, broader, septate hyphae, without *pilocystidia*. (Singer 1943: 146.)

R. albiclavipes Murr., Lloydia 8: 263. 1945. *Spores* (Fig. 14) 9-11 × 8-9 μ, warts 0.8-1.4 μ high, isolated, or a few catenulate, rarely with fine lines which are indistinct. *Pleurocystidia* 52-65 × 6-8 μ, projecting 20-35 μ, fusoid to ventricose, empty, granular, or banded, apices acute, mucronate, or capitate; *cheilocystidia* 34-42 × 5-7 μ, ventricose, mucronate to appendiculate, empty, granular, to slightly banded. *Epicutis* (Fig. 201) composed of erect to ascendant, slightly constricted hyphae, with numerous long, banded *pilocystidia*. (No studies reported by Singer.)

R. albida Pk., New York State Mus. Bull. 1 (No. 2): 10. 1887. *Spores* (Fig. 96) 8-10 × 7.5-9 μ, warts 0.5-0.8 μ high, isolated or with short ridges and some fine lines. *Epicutis* (Fig. 198) composed of erect, versiform hyphal cells which arise from a bed of pseudoparenchyma; *pilocystidia* none. (Singer 1947: 180 does not mention the pseudoparenchymatous hypodermium.)

R. albidicremea Murr., Elisha Mitchell Sci. Soc. Jour. 55: 369. 1939. *Spores* (Fig. 57) 6.5-8 × 5.7-7 μ, warts 0.3-0.5 μ high, isolated, or with long, prominent bands, fine lines rare. *Pleurocystidia* 40-58 × 6-8 μ, scattered, often inconspicuous, ventricose to subcylindric, apices tapering or appendiculate, empty, granular, or banded: *cheilocystidia* 38-46 × 4-10 μ, ventricose to cylindric, apices tapering or mucronate, empty or banded. *Epicutis* (Fig. 200) composed of scattered to moderately dense, erect or ascendant hyphae, some slightly nodulose-constricted, tending to form a turf; *pilocystidia* none. (No studies reported by Singer.)

R. albidula Pk., Torrey Bot. Club Bull. 25: 370. 1898. The type could not be located. The following notes are based on my observations of a specimen, from Albany, collected by Beardslee at Asheville, North Carolina, 1917: *Spores* (Fig. 97) 7-8.5 × 5.5-7 μ, warts 0.2-0.5 μ high, at times catenulate, with some fine lines. *Pleurocystidia* 46-88 × 6-12 μ, fusoid, apices rounded, mucronate, or appendiculate, granular or banded; *cheilocystidia* 43-55 × 5-7 μ, fusoid, empty, granular, or banded. *Epicutis* (Fig. 274) composed of slender, loosely interwoven hyphae, erect or ascendant;

with slender, clavate *pilocystidia* which are granular to banded, occasionally septate. (No studies reported by Singer.)

R. albiduliformis Murr., Lloydia 6: 209. 1943. *Spores* (Fig. 26) mostly 5-6.5 × 4-5 μ, some 7-9.5 × 5-6.5 μ, warts 0.1 μ or less (rarely 0.2 μ) in height, with fine lines which are usually indistinct. *Epicutis* (Fig. 252) composed of cylindric, ventricose, nodulose, or even subulate hyphae, tending to occur at intervals in tufts as a turf; no *pilocystidia*. (Singer 1957: 178.)

R. albiflavescens Murr., Torrey Bot. Club Bull. 66: 154. 1939. The type was not located. The following notes are based on a specimen, No. F 10052, collected and determined by Murrill: *Spores* (Fig. 13) 9-11 × 7-8.5 μ, warts 0.6-1.0 μ high, isolated or with bands, without fine lines. *Pleurocystidia* numerous, 52-105 × 8-18 μ, ventricose to clavate, apices more or less acute, often with an exudate, banded; *cheilocystidia* 36-63 × 6-11 μ, clavate to subfusoid, empty or banded. *Epicutis* (Fig. 295) not differentiated; the cuticle composed mostly of repent hyphae, but with a few erect hyphae; no *pilocystidia*. (No studies reported by Singer.)

R. albimarginata Murr., Lloydia 7: 309. 1944. *Spores* (Fig. 149) 7-9 × 6-8 μ, warts 0.6-0.8 μ high, some catenulate, with some fine lines forming an incomplete reticulum. *Pleurocystidia* 48-71 × 4-8 μ, clavate, capitate to acutely mucronate, more or less banded; *cheilocystidia* 32-50 × 4-6 μ, fusoid to subclavate, mucronate, granular to banded. *Epicutis* (Fig. 300) composed of slender (2-2.5 μ broad) hyphae, with numerous granular *pilocystidia*, in each the apical portion often flask-shaped, and all forming a turf. (No studies reported by Singer.)

R. alutaceiformis Murr., Lloydia 6: 210. 1943. *Spores* (Fig. 43) 7.5-8.5 × 5.5-7 μ, warts 0.5-0.9 μ high, with short bands and fine lines forming a limited reticulum. *Pleurocystidia* 43-96 × 7-9 μ, fusoid to clavate, usually mucronate, empty or banded; *cheilocystidia* 30-50 × 6-8 μ, fusoid to clavate, mucronate or subcapitate, empty or banded. *Epicutis* (Fig. 299) composed of slender, erect hyphae, and with numerous clavate, granular to banded *pilocystidia*. (No studies reported by Singer.)

R. amygdaloides Kauff., Agar. Mich. 1: 162. 1918. *Spores* (Fig. 45) 8-10.5 × 7-9.5 μ, warts 0.7-1.2 μ high, some isolated, some catenulate, with a few fine lines. *Epicutis* (Fig. 235) composed of a palisade of hyphae which are irregularly constricted; no *pilocystidia*. (Singer 1957: 258.)

R. anisata Murr., Lloydia 7: 310. 1944. *Spores* (Fig. 114) 8-9 (10) × 6-6.5 μ, warts 0.4-0.6 μ high, some isolated, some catenulate, with a few indistinct fine lines which may not reach another wart. *Pleurocystidia* 41-56 × 4-8 μ, ventricose, more or less appendiculate, few, often inconspicuous, banded, granular, or empty; *cheilocystidia* 37-40 × 4-6 μ, few, ventricose, appendiculate, banded or empty. *Epicutis* (Fig. 193) of slender (0.5-1.0 μ, rarely 2 μ, broad), erect or ascendant hyphae, with conspicuous, irregularly constricted, at times septate *pilocystidia*. (No studies reported by Singer.)

R. anomala Pk., New York State Mus. Ann. Rept. 50: 99. 1898. *Spores* (Fig. 36) 9-10 × 7-8.5 μ, warts 0.7-1.3 μ high, some isolated, and some with a few fine lines and broad bands. *Epicutis* (Fig. 251) composed of erect to ascendant hypae which may be nodulose-constricted, apices rounded,

capitate, or acute; with numerous banded *pilocystidia*. (Singer 1943: 145 and 1947: 174-175 states that *R. subalbidula* Murr. is a synonym of *R. anomala* Pk.)

R. appalachiensis Singer, Sydowia 2: 39. 1948. *Spores* (Fig. 27) 7.5-10 × 5.5-7.5 μ, warts 0.3-0.7 μ high, isolated or with indistinct fine lines. *Epicutis* (Fig. 290) composed of versiform hyphae—cylindric, constricted-nodulose, with apices rounded to acute—, with numerous small, clavate to constricted-cylindric, granular *pilocystidia*. The type material is meagre, and apparently the lamellae have been partially devoured by insects. (Singer 1957: 230.)

R. arnoldae Murr., Torrey Bot. Club Bull. 67: 57. 1940. Since the type was not located, a specimen, No. F 19111, collected and determined by Murrill, was studied, with notes as follows: *Spores* (Fig. 33) 9-12 × 7-9 μ, warts 0.8-1.3 μ high, isolated or some catenulate, no fine lines. *Epicutis* (Fig. 296) composed of a turf of somewhat nodulose, subulate hyphae; no *pilocystidia*. (Singer Lilloa 22: 711, footnote, says *R. arnoldae* is a typical Florida race of the *Xerampelina*-group.)

R. atropurpurea Pk., New York State Mus. Ann. Rept. 41: 75. 1888. *Spores* (Fig. 98) 8-11 × 7-8 μ, warts 0.8-1.2 μ high, isolated or catenulate, with a few fine lines. *Epicutis* (Fig. 255) composed of numerous scattered tufts of hyphae, with more or less repent hyphae between the tufts, and with buried and projecting clavate *pilocystidia*. (Singer 1942: 78 says this is a synonym of *R. xerampelina* Fr.)

R. aurantialutea Kauff., Michigan Acad. Sci. Rept. 11. 81. 1909. *Spores* (Fig. 58) 8-10 × 6.5-8 μ, warts 0.6-1.2 μ high, isolated or short-catenulate, with some fine lines. *Epicutis* (Fig. 282) composed of more or less erect, narrow hyphae with acute, rounded, or subcapitate apices. *Pilocystidia* clavate, banded 40-60 × 3-6 μ. Singer 1957: 266.)

R. australirosea Murr., Lloydia 8: 264. 1945. *Spores* (Fig. 42) 8-10.5 × 6.5-8 μ, warts 0.6-1.2 μ high, a few isolated, with broad bands and fine lines forming an incomplete reticulum. *Epicutis* (Fig. 297) composed of hyphae which are cylindric, nodulose, or ventricose, the apices at times appendiculate; *pilocystidia* not found. (Singer 1957: 215 states that the terminal elements of some hyphae are dermatocystidioid.)

R. basifurcata Pk., New York State Mus. Ann. Rept. 38: 90. 1885. *Spores* (Fig. 31) 6.8-7.5 × 5-6 μ, warts 0.1-0.2 μ high, isolated or with a few short bands. *Pleurocystidia* 56-132 × 6-14 μ, fusoid to subclavate, at times appendiculate or subcapitate, banded; *cheilocystidia* 37-70 × 6-12 μ, clavate, fusoid or subulate. *Epicutis* (Fig. 318) composed of erect or ascendant hyphae which may be septate, often constricted-nodulose, the terminal element subulate or clavate. (No studies reported by Singer.)

R. beardslei Burl., Mycologia 31: 490. 1939. *Spores* (Fig. 3) 9-11 × 5-7 μ, warts 0.1 μ or less in height, with few to many fine lines forming a partial reticulum. *Epicutis* (Fig. 292) composed of narrow, gelatinous, erect hyphae cylindric or nodulose, apices rounded or acute, with an occasional *pilocystidium*. (Singer 1957: 253.)

R. blackfordae Pk., New York State Mus. Bull. 139: 43. 1910. *Spores* (Fig. 40) 8-10 × 7-8 μ, warts 0.4-0.6 μ, rarely 1.0 μ high, with some broad

bands and a few fine lines. *Epicutis* (Fig. 262) composed of a tangle of erect and ascendant hyphae, and clavate to elongate *pilocystidia*, all forming a turf. (Singer 1957: 250.)

R. borealis Kauff., Mich. Acad. Sci. Rept. 11: 69. 1909. *Spores* (Fig. 91) 8-10 × 7-9 μ, warts 0.8-1.5 μ, isolated or catenulate, a few short lines. *Pleurocystidia* 60-77 × 5-10 μ, versiform (ventricose, cylindric, clavate, obclavate), apices rounded or appendiculate, granular or empty; *cheilocystidia* 48-56 × 6-10 μ, ventricose, bottle-shaped, clavate, empty or granular, apices acute, mucronate, or subcapitate. *Epicutis* (Fig. 234) a turf of irregularly-shaped hyphae, apices acute, rounded, or subcapitate; no *pilocystidia*. (No studies reported by Singer.)

R. brevipes Pk., New York State Mus. Ann. Rept. 54: 178. 1901. *Spores* (Fig. 113) 9-11 × 8.5-10 μ, warts 1.0-1.7 μ high, with a continuous or broken reticulum of fine lines. *Epicutis* (Fig. 253) not differentiated; the cuticle is composed of repent hyphae. (Singer 1947: 173-174 states that *R. brevipes* Pk. is a synonym of *R. delica* Fr.)

R. brunneipes Murr., Lloydia 7: 310. 1944. *Spores* (Fig. 112) 8-10.5 × 7-9 μ, warts variable in height: many 0.2-0.5 μ, others 0.8-1.2 μ high, isolated or catenulate, with some fine lines. *Pleurocystidia* 43-76 × 6-9 μ, fusoid to subventricose, apices blunt or acute, empty; *cheilocystidia* 36-45 × 6-8 μ, clavate or subfusoid, apices acute or appendiculate, empty. *Epicutis* (Fig. 172) composed of slender, erect, more or less nodulose hyphae, a few branched; *pilocystidia* present. (No studies reported by Singer.)

R. brunneola Burl., North American Flora 9: 233. 1915. *Spores* (Fig. 30) 6.5-8 × 5.4-6.5 μ, warts 0.1-0.2 μ high, isolated or a few short-catenulate, a few short fine lines. *Epicutis* (Fig. 286) composed of a palisade of septate, constricted hyphae, the terminal cell more or less acute, with one to three or more basal cells; no *pilocystidia*. (Singer 1957: 176.)

R. burkei Burl., Mycologia 16: 21. 1924. *Spores* (Fig. 7) 8-9.5 × 6.5-7.5 μ, warts 0.1 μ or less in height, fine lines forming a rather complete reticulum. *Epicutis* (Fig. 270) composed of more or less nodulose hyphae, the apices rounded or acute, with numerous banded *pilocystidia*. (Singer 1942: 79.)

R. chlorinosma Burl., Mycologia 16: 22. 1924. The type was not studied. The following notes are based on my observations of Burke's specimen, No. 799, Montgomery, Alabama: *Spores* (Fig. 47) 7-8.5 × 5.5-6.5 μ, warts 0.1 μ high, isolated or with a few fine lines. *Epicutis* (Fig. 196) composed of a palisade of septate, constricted hyphae, the terminal elements subulate, the basal cells sphaerocyst-like, the epicuticular elements resting on a pseudoparenchymatous hypodermium. The epicutis is structurally of the *virescens*-type. (Singer 1957: 193.)

R. cinerascens Beardslee, Elisha Mitchell Sci. Soc. Jour. 33: 164. 1918. The following notes are based, not on the type, but on Beardslee's collection from Asheville, 1917, on deposit at the New York Botanical Garden: *Spores* (Fig. 105) 7-9 × 6.3-7.5 μ, warts 0.2-0.4 μ high, isolated, with some fine lines, at times catenulate. *Epicutis* (Fig. 265) composed of a turf of septate-constricted hyphae, apices rounded or subcapitate; with several clavate, banded *pilocystidia*. (Singer 1942: 78-79.)

R. compacta Frost & Pk., New York State Mus. Ann. Rept. 32: 32. 1879. The following notes are based on Peck's Sandlake collection which is mentioned first in his original description. *Spores* (Fig. 63) 7-9.5 × 6-8 μ, warts 0.1-0.4 μ high, fine lines forming a reticulum. *Epicutis* (Fig. 259) not differentiated; the cuticle is composed of repent, brownish hyphae. (Singer 1943: 143.)

R. corallina Burl., North American Flora 9: 213. 1915. *Spores* (Fig. 103) 7.5-9 × 5.7-6.5 μ, warts usually less than 0.1 μ high, rarely 0.2 μ high, fine lines forming an indistinct reticulum. *Pleurocystidia* 46-68 × 6-10 μ, fusoid to ventricose, occasionally appendiculate, empty or banded; *cheilocystidia* 32-48 × 5-7 μ, ventricose, at times appendiculate, some banded. *Epicutis* (Fig. 239) composed of irregularly constricted, somewhat septate, erect hyphae, apices more or less acute; no *pilocystidia*. (No studies reported by Singer.)

R. craetegorum Murr., Florida Acad. Sci. Jour. 8: 181. 1945. *Spores* (Fig. 90) 8.5-10 × 7-8.5 μ, warts 0.6-1.0 μ high, isolated or a few catenulate, with fine lines. *Pleurocystidia* 58-78 × 7-12 μ, clavate, ventricose, at times constricted, apices rounded or more often appendiculate, empty, granular, or banded; *cheilocystidia* 41-53 × 7-12 μ, ventricose, clavate, or subfusoid, apices rounded or mucronate, empty. *Epicutis* (Fig. 233) composed of a turf of hyphae which are somewhat septate and constricted, some hyphae with swollen cells; no *pilocystidia*. (No studies reported by Singer.)

R. cremea (Murr.) Singer, Lilloa 22: 711. 1949. *Spores* (Fig. 106) 8.5-11 × 5.4-6.3 μ, warts 0.1 μ or less in height, rarely 0.2 μ high, fine lines forming a reticulum. *Epicutis* (Fig. 285) composed of more or less nodulose hyphae, usually tapering at apex, erect or ascendant; no *pilocystidia*. (Singer 1957: 209 lists *R. heterospora* var. *cremea* Murr. as a synonym.)

R. cremeirosea Murr., Lloydia 8: 265. 1945. *Spores* (Fig. 137) 8-11 × 7.5-10 μ, warts 0.8-1.4 μ high, isolated or with a few indistinct fine lines. *Pleurocystidia* 50-76 × 3-10 μ, ventricose to cylindric-constricted, apices acute or appendiculate, empty, granular, or banded; *cheilocystidia* 42-48 × 7-9 μ, ventricose or obclavate, apices mucronate to rounded, empty. *Epicutis* (Fig. 237) composed of more or less erect, cylindric or constricted hyphae, the apices acute or rounded, rarely septate; no *pilocystidia*. (No studies reported by Singer.)

R. cremeirubra Murr., Lloydia 8: 265. 1945. *Spores* (Fig. 101) 8-9.5 × 7-8 μ, warts 0.4-0.6 μ high, a few isolated, catenulate, with an occasional fine line. *Pleurocystidia* 42-76 × 7-10 μ, ventricose to fusoid, often long-appendiculate, empty or granular; *cheilocystidia* 27-43 × 5-7 μ, ventricose, mucronate or appendiculate, empty or granular. *Epicutis* (Fig. 236) composed of scattered, narrow (1-3), erect or ascendant hyphae, some broader and septate; no *pilocystidia*. (No studies reported by Singer.)

R. crustosa Pk., New York State Mus. Ann. Rept. 39: 41. 1887. *Spores* (Fig. 29) 7-8 × 5.7-6.5 (7.5) μ, warts 0.2-0.3 μ high, at times shorter, isolated, or at times catenulate or with fine lines. *Epicutis* (Fig. 195) composed of a turf of versiform hyphae with tapering apices, which arise from a pseudoparenchymatous hypodermium,—a *virescens*-type of epicutis; no *pilocystidia*. (Singer 1957: 197.)

R. cystidiosa Murr., Torrey Bot. Club Bull. 67: 57. 1940. *Spores*

(Fig. 46) 9-12 × 9-10 μ, warts more or less cylindric, 0.8-1.8 μ high, a few isolated, some catenulate, with some fine lines. *Epicutis* (Fig. 281) composed of erect hyphae which are somewhat constricted; *pilocystidia* clavate, banded. (Singer 1957: 228.)

R. diaboli Singer, Lilloa 22: 719. 1949. *Spores* (Fig. 121) 8-10.5 × 7-8.5 μ, warts 0.5-0.7 μ high, isolated or catenulate, with some fine lines. *Epicutis* (Fig. 283) composed of erect hyphae, some slightly nodulose, apices attenuated, with numerous granular to banded *pilocystidia*. (Singer 1957: 270.)

R. earlei Pk., New York State Mus. Bull. 67: 24. 1903. *Spores* (Fig. 102) 5.5-7.5 × 4-5 μ, warts 0.2-0.3 μ high, isolated, rarely with a few short, inconspicuous, fine lines. *Epicutis* (Fig. 266) composed of erect, septate, constricted hyphae; *pilocystidia* none. (Singer 1957: 143.)

R. eccentrica Pk., New York State Mus. Bull. 150: 61. 1911. *Spores* (Fig. 104) 7-9 × 5.7-7.5 μ, warts very short punctations, often indistinct and then the wall appears smooth, with a few faint lines. *Epicutis* (Fig. 182) not differentiated; the cuticle composed of repent hyphae, with a few more or less erect free ends. (Singer 1957: 146 considers this to be a subspecies of *R. nigricans* Fr.)

R. emeticiformis Murr., Mycologia 30: 362. 1938. *Spores* (Fig. 75) 8-11 × 7-9 μ, warts 0.6-1.3 μ high, isolated or with few to many fine lines. *Epicutis* (Fig. 209) composed of slender, more or less nodulose to cylindric hyphae, with several clavate, minutely banded *pilocystidia*. (Singer 1957: 232 doubtfully calls this a synonym of *R. emetica* ssp. *lacustris* Singer, differing in its darker pileus.)

R. ferrotincta Singer, Mycologia 37: 428. 1945. Notes on co-type, No. F 1889c: *Spores* (Fig. 34) 7-9 × 6.3-7 μ, warts 0.3-0.6 μ high, isolated, some nearly catenulate, with some fine lines. *Epicutis* (Fig. 280) composed of erect, narrow, clavate to fusoid hyphae, the apices rounded to acute, with more or less buried *pilocystidia*. (Singer 1945: 429 does not mention *pilocystidia*.)

R. flaviceps Pk., New York State Mus. Ann. Rept. 53: 843. 1901. *Spores* (Fig. 153) 7.5-9.5 × 7-7.5 μ, warts blunt, 0.4-0.6 μ high, with some ridges and fine lines. *Epicutis* (Fig. 264) composed of erect hyphae, at times branched, with clavate, banded *pilocystidia*. (Singer 1957: 254.)

R. flocculosa Burl., North American Flora 9: 213. 1915. *Spores* (Fig. 52) 7-9 × 5.5-7 μ, warts 0.2-0.3 μ high, with a few fine lines. *Epicutis* (Fig. 288) composed of tufts of erect hyphae which are septate-constricted, the apices often tapering; no *pilocystidia*. (Singer 1942: 75.)

R. floridana Murr., Torrey Bot. Club Bull. 67: 145. 1940. *Spores* (Fig. 109) 8-11.5 × 6.3-8 μ, warts 0.5-0.8 μ high, isolated, rarely short-catenulate, a few indistinct fine lines. *Epicutis* (Fig. 189) composed of erect hyphae, at times in tufts, accompanied by clavate, banded *pilocystidia*. (Singer 1957: 218 regards this as a synonym of *R. xerampelina* var. *semirubra* Singer.)

R. foetentula Pk., New York State Mus. Bull. 116: 85. 1907. *Spores* (Fig. 67) 8-10 × 7-8 μ, warts 0.7-1.2 μ high, isolated, with ridges and fine lines. *Epicutis* (Fig. 181) composed of tufts of hyphae, at times con-

stricted; these tufts constitute the granules seen on the surface of the pileus; no *pilocystidia*. (Singer 1943: 114 reports on spore ornamentation but does not mention the epicutis.)

R. fosteriana Murr., Lloydia 6: 210. 1943. *Spores* (Fig. 134) 7-8.5 × 5-6.3 μ, warts 0.2-0.4 μ high, at times mere punctations, isolated or slightly catenulate, with a few short, indistinct fine lines. *Pleurocystidia* 50-66 × 7-12 μ, ventricose, appendiculate, empty or banded; *cheilocystidia* 48-63 × 6-8 μ, ventricose, more or less mucronate or appendiculate, granular or banded. *Epicutis* (Fig. 279) rarely as scattered, more or less erect hyphae; with banded *pilocystidia*, the apices rounded to appendiculate. (No studies reported by Singer.)

R. fragilioides Murr., Lloydia 8: 265. 1945. *Spores* (Fig. 100) 7-9 × 6.5-7.5 μ, warts 0.5-0.8 μ high, with some short bands, few to many fine lines. *Epicutis* (Fig. 173) composed of more or less erect, somewhat tangled hyphae, the apices acute to tapering; with clavate, banded or granular *pilocystidia*. (Singer 1957: 234 places this species in synonomy with *R. emetica* ssp. *emeticella* (Singer) Singer.)

R. furcatifolia Murr., Lloydia 6: 210. 1943. *Spores* (Fig. 84) 8-10 × 7-8.5 μ, warts 0.8-1.3 μ high, isolated, with many fine lines some not reaching another wart, at times short-catenulate. *Epicutis* (Fig. 214) composed of cylindric to nodulose-constricted hyphae, the apices acute to subcapitate; *pilocystidia* numerous, banded, the apices acute to subcapitate. (Singer 1957: 151 places this species in synonomy with *R. subsericeonitens* Murr.)

R. glauca Burl., North American Flora 9: 222. 1915. The following notes are based on a study of Burlingham's collection No. 18-1911: *Spores* (Fig. 51) 7-8.5 × 5-5.7 μ, warts 0.1-0.3 μ high, isolated, with a few fine lines. *Pleurocystidia* 50-63 × 7-10 μ, ventricose, more or less appendiculate, at times subcapitate, granular or banded; *cheilocystidia* 33-54 × 5-7 μ, ventricose, apices acute or capitate, empty or banded. *Epicutis* (Fig. 240) composed of erect hyphae, scattered or in tufts, some septate and slightly constricted, others non-septate, the apices tapering; no *pilocystidia*. (No studies reported by Singer.)

R. glaucescentipes Murr., Lloydia 6: 211. 1943. *Spores* (Fig. 83) 7-8.5 × 6.3-7.5 μ, warts 0.7-1.0 μ high, some isolated, some with fine lines which may not always reach another wart, a few catenulate. *Epicutis* (Fig. 202) composed of a few erect or ascendant hyphae with acute apices; no *pilocystidia*. (Singer 1957: 202 reports "strange elongate elements" in the epicutis.)

R. granulata Pk.. New York State Mus. Ann. Rept. 53: 843. 1901. *Spores* (Fig. 35) 7-8.5 × 5.5-6.5 μ. warts 0.4-0.8 μ high, most 0.5 μ or less, isolated or with a few short lines. *Epicutis* (Fig. 245) composed of tufts (squamules) of pale brownish, septate hyphae which may be constricted and the apices acute or capitate. In areas between tufts, the surface hyphae are repent. No *pilocystidia* found. (Singer 1957: 160 reports *pseudocystidia* on the pileus.)

R. granulosula Murr., Lloydia 6: 211. 1943. *Spores* (Fig. 48) 7.5-9 × 7-8 μ, warts 0.5-1.2 μ high, with a reticulum of broad bands and a few fine lines. *Pleurocystidia* 66-86 × 10-15 μ, ventricose, apices tapering,

empty; *cheilocystidia* 51-66 × 6-10 μ, ventricose, cylindric, or constricted, apices acute, at times appendiculate, empty. *Epicutis* (Fig. 257) composed of tufts of hyphae which may be brown, may arise from one or two basal cells, the apices more or less subulate; no *pilocystidia*. (No studies reported by Singer.)

R. heterospora Beardslee, Mycologia 26: 259. 1934. The following notes are based on a study of a collection by Beardslee labelled "type woods," November 16, 1938: *Spores* (Fig. 1) 8-13.5 × 4.5-6.3 μ, warts less than 0.1 μ high or nearly smooth, isolated or with an indistinct reticulum of fine lines. *Epicutis* (Fig. 183) scarcely differentiated; the cuticle composed of repent hyphae with an occasional more or less erect hypha; no *pilocystidia*. (Singer 1957: 173.)

R. heterosporoides Murr., Lloydia 7: 310. 1944. *Spores* (Fig. 25) 7-8 × 4-5 μ, warts less than 0.1 μ high or nearly smooth, isolated or with a few fine lines. *Epicutis* (Fig. 175) composed of a palisade of cells with rounded or acute apices, all arising from a pseudoparenchymatous hypodermium,—a *virescens*-type of epicutis. (Singer 1957: 196.)

R. hixsoni Murr., Lloydia 6: 212. 1943. *Spores* (Fig. 41) (8.5) 11-13.5 × 7.5-10.5 μ, warts nearly cylindric, 1.2-1.7 μ high, isolated, rarely catenulate, with a few fine lines which may not reach the next wart. *Epicutis* (Fig. 199) composed of hyphae, scattered or in tufts, more or less clavate, the apices acute to subcapitate; no *pilocystidia*. (Singer 1957: 209.)

R. incarnaticeps Murr., Torrey Bot. Club Bull. 67: 277. 1940. *Spores* (Fig. 64) 7.5-11 × 6.3-8.5 μ, warts 0.8-1.3 μ, more or less cylindric, some isolated, others with fine lines and coarse bands forming an incomplete reticulum. *Epicutis* (Fig. 278) composed of more or less erect, narrow hyphae, the apices rounded or acute; *pilocystidia* with species acute or clavate. (Singer 1957: 219.)

R. inedulis Murr., Lloydia 7: 311. 1944. *Spores* (Fig. 28) 8-10.5 × 7-9 μ, warts 0.2-0.5 μ high, some isolated, others with broad ridges and a few fine lines. *Pleurocystidia* 56-88 × 9-12 μ, ventricose to subfusoid, appendiculate, the appendages acute to capitate, banded; *cheilocystidia* 45-58 × 7-10 μ, ventricose, apices rounded to appendiculate, empty. *Epicutis* (Fig. 276) composed of hyphae, clavate or constricted, the apices acute; *pilocystidia* clavate, or with apices appendiculate, granular to minutely banded. (No studies reported by Singer.)

R. leucomodesta Singer, Sydowia 11: 178. 1957. *Spores* (Fig. 12) 7-9 × 5.7-7 μ, warts 0.5-0.7 (1.0) μ high, mostly isolated, a few catenulate. *Epicutis* (Fig. 275) composed of hyphae which are scattered to clustered, septate, the apices acute to rounded; *pilocystidia* numerous, banded or granular, somewhat cylindric, apices acute to rounded.

R. levispora Murr., Lloydia 6: 212. 1943. The following notes are based on a study of Murrill's No. F 17449: *Spores* (Fig. 156) 7.5-9.5 × 6.3-8 μ, warts 0.1-0.2 μ high or less, with fine lines and a few short ridges forming a reticulum. *Epicutis* (Fig. 176) composed of a turf of constricted-nodulose hyphae with rounded sub-acute apices; no *pilocystidia*. (Singer 1957: 191 regards this species as a synonym of *R. ochroleucoides* Kauff.)

R. levyana Murr., Lloydia 7: 311. 1944. *Spores* (Fig. 152) 9-12 × 8-10 μ, warts 0.5-1.3 μ high, isolated or with some fine lines, at times short-catenulate. *Epicutis* (Fig. 301) composed of cylindric and non-septate or constricted and septate hyphae, with a few rather inconspicuous, granular to minutely banded *pilocystidia*. (Singer 1957: 218 regards this as a synonym of *R. xerampelina* var. *semirubra* Sing.)

R. lividirosea Murr., Torrey Bot. Club Bull. 67: 278. 1940. *Spores* (Fig. 127) 7.5-10 × (5.5) 7-8 μ, warts 0.6-0.8 μ high, isolated or with bands and fine lines forming somewhat of a reticulum. *Epicutis* (Fig. 258) composed of scattered tufts, the hyphae more or less subulate, arising from one or two basal cells; no *pilocystidia*. (Singer 1957: 229.)

R. luteispora Murr., Lloydia 7: 311. 1944. *Spores* (Fig. 44) 7-8.5 × 5-6.3 μ, warts 0.2-0.5 μ high, a few isolated, bands and lines forming a more or less complete reticulum. *Pleurocystidia* 33-48 × 6-8 μ, ventricose, appendiculate, mostly buried, scattered, inconspicuous, more numerous near the edges of the lamellae, granular; *cheilocystidia* 30-45 × 4-6 μ, ventricose to cylindric, faintly constricted, apices acute or mucronate, empty. *Epicutis* (Fig. 277) composed of scattered to dense erect hyphae, some slender and non-septate, others broader, septate-constricted, the terminal element somewhat granular; no *pilocystidia*. (No studies reported by Singer.)

R. luteobasis Pk., Torrey Bot. Club Bull. 31: 179. 1904. *Spores* (Fig. 66) 7-9 × 6-7 μ, warts 0.6-0.9 μ high, ridges and fine lines forming a reticulum. *Epicutis* (Fig. 315) composed of a turf of hyphae which may occur in tufts, some slender-cylindric, others broader and septate, clavate, spathulate, or subfusoid; no *pilocystidia*. (Singer 1957: 206.)

R. lutescentifolia Murr., Lloydia 8: 267. 1945. *Spores* (Fig. 62) 7.5-9 × 6-7 (8) μ, warts 0.2-0.3 μ high, broad bands and fine lines forming a reticulum. *Epicutis* (Fig. 174) composed of a turf of hyphae which are clavate to fusoid, often appendiculate, occasionally septate; no *pilocystidia*. (Singer 1957: 191 regards this as a synonym of *R. ochroleucoides* Kauff.)

R. macropoda Singer, Bull. Soc. Mycol. Fr. 55: 277. 1939. The following notes are based on a specimen collected and determined by Singer, V-270, Mountain Lake, Virginia: *Spores* (Fig. 145) 7.5-10 × 7-8.5 μ, warts 0.6-1.2 μ high, isolated, some catenulate, with a few fine lines. *Epicutis* (Fig. 210) composed of a turf of hyphae imbedded in a transparent gelatinous zone and disposed at more or less at 45°-angle, with clavate, banded *pilocystidia*. (Singer 1957: 268.)

R. maculosa Murr., Lloydia 6: 212. 1943. The following notes are based on a study of a Florida specimen collected and determined by Murrill: *Spores* (Fig. 132) 7-8.5 × 5-6 μ, warts 0.1 μ high, isolated or with a few fine connecting lines. *Epicutis* (Fig. 294) composed of hyphae which are septate-constricted, the cells progressively larger downward, and arising from a zone of pseudoparenchyma,—a *virescens*-type of epicutis; no *pilocystidia*. (Singer 1957: 193-194 regards this as a synonym of *R. chlorinosma* Burl.)

R. magna Beards., Elisha Mitchell Sci. Soc. Jour. 33: 183. 1918. The following notes are based on a specimen collected and determined by Beardslee. Asheville, North Carolina, August 10, 1917: *Spores* (Fig. 22) 8.5-11 × 7.5-10 μ, warts 0.2-0.4 μ high, with a reticulum of broad bands

and fine lines. *Epicutis* (Fig. 224) composed of hyphae which are clavate, cylindric, or fusoid, hyaline or brownish, with rounded or tapering apices; with clavate, banded *pilocystidia*. (Singer 1942: 80.)

R. magnifica Pk., New York State Mus. Bull. 67: 24. 1903. *Spores* (Fig. 54) 7-9 × 5.7-7 μ, warts 0.1-0.4 μ, isolated or with a few fine lines which fail to reach another wart. *Epicutis* (Fig. 249) in young pilei composed of cylindric to clavate hyphae, apices acute, rounded, or capitate; in mature pilei, the epicuticular hyphae slough away leaving a cuticular surface of repent hyphae. *Pilocystidia* none. (Singer 1943: 142 assumes this to be a synonym of *R. polyphylla* Pk.)

R. mariae Pk., New York State Mus. Ann. Rept. 24: 74. 1872. *Spores* (Fig. 65) 7.5-9.5 × 6.5-8 μ, warts 0.6-1.0 μ high. *Epicutis* (Fig. 197) composed of a turf of septate-constricted hyphae, with one or more basal cells, apices tapering or filiform; no *pilocystidia*. (Singer 1957: 185.)

R. modesta Pk., New York State Mus. Bull. 116: 78. 1907. *Spores* (Fig. 140) 6.3-9 × 5-6.5 μ, warts 0.1-0.4 μ high, isolated, at times catenulate or with fine lines. *Epicutis* (Fig. 289) composed of a turf of hyphae in a gelatinous zone, the terminal elements subulate, often the hypha arises from a cell or a chain of 2-4 cells; clavate *pilocystidia* present. (Singer 1957: 179.)

R. mutabilis Murr., Torrey Bot. Club Bull. 67: 146. 1940. *Spores* (Fig. 60) 8-10.5 × 7.5-9 μ, warts 0.9-1.4 μ high, coarse and blunt, isolated, with some fine lines and a few short bands. *Epicutis* (Fig. 194) composed of more or less repent hyphae; scattered over the surface are pulverulent areas composed of brownish, slender, erect hyphae; no *pilocystidia*. (Singer 1957: 160.)

R. mutantipes Murr., Lloydia 8: 267. 1945. *Spores* (Fig. 86) 8-10 × 6.3-8 μ, warts 0.8-1.2 μ high, isolated with some short ridges and indistinct fine lines. *Pleurocystidia* 45-76 × 7-9 μ, ventricose, apices obtuse, acute, or mucronate, granular; *cheilocystidia* 35-54 × 5-8 μ, ventricose, apices acute or mucronate-subcapitate, granular or banded. *Epicutis* (Fig. 242) composed of tufts of hyphae which are usually either cellular or arise from a basal cell; no *pilocystidia*. (No studies reported by Singer.)

R. nigrescentipes Pk., Torrey Bot. Club Bull. 33: 214. 1906. *Spores* (Fig. 70) 7-9 × 5.7-7.5 μ, warts 0.4-0.6 μ high, isolated or with bands and fine lines forming an incomplete reticulum. *Epicutis* (Fig. 256) composed of a turf of hair-like hyphae which seem gelatinous, each hypha arising from rounded basal cell, all resting on a zone of tangentially parallel hyphae; no *pilocystidia*. (Singer 1943: 148.)

R. nigrodisca Pk., Fur Seals North Pacific 3: 583. 1899. *Spores* (Fig. 130) 8.5-10 × 7-7.5 μ, warts 0.2-0.4 μ high, ridges and fine lines forming a more or less complete reticulum. *Epicutis* (Fig. 228) composed of erect hyphae which are somewhat constricted, with clavate *pilocystidia*. (Singer 1943: 149 says this does not seem to be different from *R. emetica* ssp. *alpestris* (Boud.) Singer,—an alpine form.)

R. novispora Murr., Mycologia 36: 309. 1944. *Spores* (Fig. 53) 8-10 × 4.5-6 μ, warts 0.1 μ or less in height, isolated or some short-catenulate, and with some fine lines. *Pleurocystidia* 50-91 × 7-13 μ, ventricose, fusoid, or irregular, apices acute, at times appendiculate, granular; *cheilocystidia*

33-45 × 5-7 μ, ventricose, apices blunt, acute, or at times appendiculate, empty, granular, or banded. *Epicutis* (Fig. 304) composed of erect hyphae which are cylindric, clavate, or fusoid, at times constricted; *pilocystidia* numerous, clavate or subcapitate. (No studies reported by Singer.)

R. obscuriformis Murr., Lloydia 7: 312. 1944. *Spores* (Fig. 150) 8-9.5 × 6.3-8 μ, warts 0.5-0.8 μ high, broad bands and fine lines forming an incomplete reticulum. *Pleurocystidia* 36-64 × 5-10 μ, ventricose, often constricted, appendiculate, empty; *cheilocystidia* 30-43 × 6-11 μ, ventricose, appendiculate, empty. *Epicutis* (Fig. 260) composed of erect to ascendant hyphae, with rather rare and inconspicuous *pilocystidia*. (No studies reported by Singer.)

R. ochroleuciformis Murr., Lloydia 8: 267. 1945. *Spores* (Fig. 21) 7-8 × 5.5-7 μ, warts 0.1-0.2 μ high, rather strongly banded and with a few fine lines. *Pleurocystidia* 52-67 × 5-10 μ, ventricose, appendiculate, granular or banded; *cheilocystidia* 35-52 × 4-8 μ, ventricose, bottle-shaped, or subclavate, apices appendiculate or mucronate, empty or banded. *Epicutis* (Fig. 190) composed of erect, somewhat scattered hyphae; no *pilocystidia*. (No studies reported by Singer.)

R. ochroleucoides Kauff., Mycologia 9: 165. 1917. *Spores* (Fig. 9) 8.5-10 × 7-8 μ, warts 0.1-0.2 (0.3) μ high, bands and fine lines forming a reticulum. *Epicutis* (Fig. 188) composed of a turf of more or less erect hyphae; no *pilocystidia*. (Singer 1957: 191.)

R. ochrophylla Pk., New York State Mus. Ann. Rept. 50: 100. 1897. *Spores* (Fig. 147) 8.5-12 × 7-9 μ, warts 0.5-0.8 μ high, at times isolated, again catenulate, with a few short lines. *Epicutis* (Fig. 238) composed of erect hyphae, at times slightly constricted, apices rounded or slightly tapering; no *pilocystidia*. (Singer 1939: 252 says that this is a synonym of *R. olivacea* (Schaeff. ex Schw.) Fr.)

R. palustris Pk., New York State Mus. Ann. Rept. 53: 842. 1900. *Spores* (Fig. 80) 8-10 × 5.5-8 μ, warts 0.3-0.8 μ high, at times isolated, often short-catenulate and with a few fine lines. *Epicutis* (Fig. 232) composed of erect hyphae which are slender with tapering or acute apices; *pilocystidia* clavate, numerous. (Singer 1957: 242 lists this in synonymy with *R. pulchella* Borszcz.)

R. partirosea Murr., Lloydia 8: 268. 1945. The following notes are based on a study of a topotype collection by Murrill: *Spores* (Fig. 94) 7.8-9.3 × 7-8 μ, warts 0.2 μ high or less, at times catenulate, with a few fine lines. *Pleurocystidia* 50-71 × 7-11 μ, clavate, apices rounded or mucronate, at times appendiculate, banded; *cheilocystidia* 28-50 × 5-10 μ, clavate, capitate or mucronate, empty or banded. *Epicutis* (Fig. 177) composed of erect, slender hyphae, with clavate, more or less banded *pilocystidia*. (No studies reported by Singer.)

R. patriotica Murr., Mycologia 40: 635. 1948. *Spores* (Fig. 78) 8-11 × 7-9 μ, warts 0.3-0.5 μ high, isolated or catenulate, with a few fine lines. *Pleurocystidia* 47-68 × 6-12 μ, clavate, often appendiculate, granular; *cheilocystidia* 34-52 × 6-10 μ, clavate, fusoid or ventricose, acute, appendiculate, or capitate. *Epicutis* (Fig. 293) composed of numerous pyramidal tufts of hyphae, at times tinged brownish; *pilocystidia* banded or granular, clavate. (No studies reported by Singer.)

R. peckii Singer, Mycologia 35: 147. 1943. The following notes are based on a study of a collection determined by Singer: *Spores* (Fig. 129) 8-9.5 × 7-8 μ, warts 0.4-0.6 μ high, fine lines forming a more or less complete reticulum. *Epicutis* (Fig. 207) composed of erect or ascendant hyphae, with clavate *pilocystidia*-like bodies. (Singer 1943: 147 proposed this binomial for *R. purpurina* Schulzer, *sensu* Peck. He (1957: 217) regards the pilocystidia-like bodies as bluing hyphal ends.)

R. pectinatoides Pk., New York State Mus. Bull. 116: 43. 1907. *Spores* (Fig. 61) (6.5) 7.5-9 × 5.5-7.5 μ, warts 0.4-0.6 μ high, a few isolated, mostly short-catenulate with fine lines forming an incomplete reticulum. *Epicutis* (Fig. 250) composed of loosely arranged, erect or ascendant hyphae, with a few conducting hyphae. (Singer 1957: 164.)

R. perlactea Murr., Lloydia 6: 213. 1943. *Spores* (Fig. 146) 10-13.5 × 8.5-10.5 μ, warts 0.8-1.7 μ high, somewhat cylindric, some isolated, with fine lines. *Epicutis* (Fig. 272) composed of clavate, fusoid, or cylindric hyphae, the apices acute or subcapitate; *pilocystidia* clavate, numerous. (Singer 1957: 232 regards this as a synonym of *R. emetica* ssp. *lacustris* Singer,—merely a white form.)

R. perplexa Burl., Mycologia 10: 96. 1918. *Spores* (Fig. 16) 9-11.8 × 7-8.5 μ, warts 0.8-1.5 μ high, isolated or with some fine lines forming an incomplete reticulum. *Epicutis* (Fig. 268) composed of gelatinized, loosely arranged hyphae, with several cylindric to clavate *pilocystidia*. (Singer 1957: 216.)

R. pervirginea Murr., Lloydia 8: 268. 1945. *Spores* (Fig. 128) 8-10 × 7-8.5 μ, warts 0.5-1.0 μ high, rarely catenulate, fine lines forming a more or less complete reticulum. *Epicutis* (Fig. 291) composed of versiform hyphae (cylindric, nodulose, ampullaceous, the apices rounded or acute); *pilocystidia* somewhat fusoid to irregular, granular to banded. (Singer 1957: 232 doubtfully lists this as a synonym of *R. emetica* ssp. *lacustris* Singer, pointing out that in *R. pervirginea* the spores are slightly smaller.)

R. pinetorum Murr., Torrey Bot. Club Bull. 66: 155. 1939. *Spores* (Fig. 81) 8.5-10 × 7-8 μ, warts 0.8-1.4 μ high, some isolated, with some fine lines. *Pleurocystidia* 47-61 × 7-8 μ, ventricose, acute or appendiculate, granular or banded; *cheilocystidia* 41-45 × 3-5 μ, fusoid, acute or appendiculate, empty. *Epicutis* (Fig. 307) composed of erect or ascendant hyphae which are cylindric, constricted, apices more or less tapering; *pilocystidia* numerous. (No studies reported by Singer.)

R. pinicola Murr., Lloydia 6: 213. 1943. *Spores* (Fig. 82) 9-10.5 × 7-8.5 μ, warts 0.6-1.0 μ high, more or less cylindric, isolated or with some fine lines. *Pleurocystidia* 54-64 × 5-11 μ, ventricose, at times constricted, apices appendiculate, empty or granular; *cheilocystidia* 47-55 × 7-8 μ, ventricose, clavate, or obclavate, mucronate or appendiculate, granular or banded. *Epicutis* (Fig. 267) composed of erect or ascendant hyphae which are cylindric, constricted, apices more or less tapering; *pilocystidia* numerous. (No studies reported by Singer.)

R. pinophila Murr., Florida Acad. Sci. Jour. 8: 182. 1945. *Spores* (Fig. 120) 8-11 × 7-9 μ, warts 0.8-1.2 μ high, isolated to catenulate, or with a few fine lines. *Epicutis* (Fig. 311) composed of septate or non-

septate hyphae, with scattered clavate *pilocystidia*. (Singer 1957: 221 places this in synonymy with *R. pusilla* Pk.)

R. praeclavipes Murr., Lloydia 6: 213. 1943. The following notes are based on a specimen collected and determined by Murrill, Gainesville, Florida, September 21, 1938: *Spores* (Fig. 142) 8-9 × 7-8 μ, warts 0.6-1.2 μ high, isolated, a few catenulate, some fine lines. *Pleurocystidia* few, 48-62 × 6-11 μ, fusoid or clavate, blunt, acute, or appendiculate, granular or banded; *cheilocystidia* few, 37-45 × 5-7 μ, fusoid or clavate, mucronate or appendiculate, empty or banded. *Epicutis* (Fig. 160) composed of more or less erect, cylindric to constricted hyphae, with clavate, granular to minutely banded *pilocystidia*. (No studies reported by Singer.)

R. praecompacta Murr., Lloydia 7: 312. 1944. *Spores* (Fig. 143) 7.5-9 × 6.3-7.5 μ, warts 0.5-0.7 μ high, isolated or with a few indistinct fine lines. *Pleurocystidia* 48-66 × 7-10 μ, ventricose or clavate, rounded or appendiculate, empty, granular, or banded; *cheilocystidia* 44-55 × 5-7 μ, clavate, fusoid, or constricted, apices acute or appendiculate, granular or minutely banded. *Epicutis* (Fig. 273) composed of numerous small tufts, between the tufts the hyphae are erect or ascendant; *pilocystidia* numerous. (No studies reported by Singer.)

R. praerubra Murr., Lloydia 6: 211. 1943. *Spores* (Fig. 119) 9-11 × 7.5-9 μ, warts 0.8-1.3 μ high, numerous, some isolated, with indistinct fine lines. Pleurocystidia 50-68 × 7-11 μ, ventricose, more or less constricted, acute or appendiculate, upper portion empty or banded; *cheilocystidia* 38-76 × 5-8 μ, fusoid to cylindric, often somewhat constricted, acute, appendiculate, or capitate. *Epicutis* (Fig. 206) composed of a turf of versiform hyphae—clavate, subcylindric, constricted, fusoid—non-septate; no *pilocystidia*. (No studies reported by Singer.)

R. praerubriceps Murr., Lloydia 6: 215. 1943. The following notes are based on a study of a specimen collected and determined by Murrill, F 19399: *Spores* (Fig. 141) 9-11 × 7-10 μ, warts 0.7-1.4 μ high, some isolated, with some fine lines. *Epicutis* (Fig. 161) composed of numerous tufts of slender hyphae; with many clavate, granular *pilocystidia*. (Singer 1957: 218 lists this as a synonym of *R. xerampelina* var. *semirubra* Singer.)

R. praetenuis Murr., Lloydia 6: 215. 1943. *Spores* (Fig. 135) 7-9 × 5.5-7 μ, warts 0.2-0.7 μ high, isolated, often with fine lines or bands, a few catenulate. *Epicutis* (Fig. 244) composed of hyphae which are erect or ascendant, more or less constricted, scattered or in loose tufts, some of the hyphae arising from a swollen basal cell, or more rarely a chain of two or more cells; no *pilocystidia* (Singer 1957: 204.)

R. pseudofoetens Murr., Lloydia 7: 312. 1944. *Spores* (Fig. 55) 7.5-9 × 6-7.5 μ, warts 0.3-0.5 μ high, with a few fine lines. *Pleurocystidia* few, 42-74 × 6-10 μ, fusoid, ventricose, or subcylindric, mucronate or appendiculate, banded; *cheilocystidia* 38-56 × 5-7 μ, fusoid or clavate, empty or banded. *Epicutis* (Fig. 162) composed of slender hyphae which are cylindric, often constricted; with clavate, granular *pilocystidia*. (No studies reported by Singer.)

R. pseudolepida Singer, Bull. Soc. Myc. Fr. 55: 251. 1939. The following notes are based on a study of a specimen, No. F 3418, collected and determined by Singer, Alachua County, Florida, July 30, 1947: *Spores*

(Fig. 72) 7-9.5 × 6.3-8 μ, warts 0.5-1.0 μ high, isolated or with some fine lines. *Epicutis* (Fig. 309) composed of a turf of slender hyphae, the terminal elements rounded, acute, or capitate; no *pilocystidia*. (Singer 1948: 114.)

R. pulchra Burl., Mycologia 10: 95. 1918. *Spores* (Fig. 85) 8-11 × 7-8.5 μ, warts 1.0-1.4 μ high, some short-catenulate, others isolated, with a few indistinct fine lines. *Epicutis* (Fig. 248) composed of loosely interwoven hyphae some of which are erect or ascendant, at times constricted; no *pilocystidia*. (Singer 1957: 213.)

R. pungens Beardslee, Elisha Mitchell Sci. Soc. Jour. 33: 196. 1918. The following notes are based on a specimen from Asheville, North Carolina, 1917, collected and named by Beardslee: *Spores* (Fig. 118) 9.5-12 × 7.5-10 μ, warts numerous, 0-7-1.3 μ high, isolated or occasionally short-catenulate, fine lines present or absent. *Pleurocystidia* 58-110 × 6-11 μ, fusoid to subclavate, often mucronate or appendiculate, banded; *cheilocystidia* 50-80 × 6-8 μ, fusoid or clavate, or irregular, rounded, at times mucronate, banded. *Epicutis* (Fig. 223) composed of a turf of slender, cylindric hyphae, and clavate, banded *pilocystidia*. (No studies reported by Singer.)

R. pusilla Pk., New York State Mus. Ann. Rept. 50: 99. 1897. *Spores* (Fig. 125) 7.5-9.5 × 5-7 μ, warts 0.4-0.6 μ high, some catenulate, others isolated, often with fine lines. *Epicutis* (Fig. 225) composed of a turf of more or less erect, at times constricted hyphae with rounded to acute apices; *pilocystidia* with banded contents. (Singer 1957: 221.)

R. pusilliformis Murr., Florida Acad. Sci. Jour. 8: 182. 1945. *Spores* (Fig. 123) 8-9.5 × 7-8 μ, warts 0.5-1.2 μ high, isolated or catenulate, with some fine lines. *Pleurocystidia* 50-63 × 6-12 μ, ventricose, acute or appendiculate, banded, granular, or empty; *cheilocystidia* 45-52 × 6-7 μ, ventricose, at times constricted, rounded, capitate, or acute, empty or banded. *Epicutis* (Fig. 254) composed of scattered to gregarious, erect or ascendant hyphae which are septate-constricted, the terminal element often appendiculate or subulate; with several *pilocystidia*. (No studies reported by Singer.)

R. regalis Murr., Torrey Bot. Club Bull. 67: 231. 1940. *Spores* (Fig. 87) 8.5-11 × 7.5-9 μ, warts 0.6-1.0 μ high, isolated or with some fine lines. *Pleurocystidia* 52-76 × 3-10 μ, ventricose to cylindric, acute or appendiculate, empty, granular, or banded; *cheilocystidia* 52-63 × 6-7 μ, ventricose or clavate, at times constricted, granular or banded. *Epicutis* (Fig. 306) composed of erect or ascendant hyphae which are usually constricted, the terminal element subulate to flask-shaped; no *pilocystidia*. (No studies reported by Singer.)

R. rimosa Murr., Lloydia 8: 270. 1945. *Spores* (Fig. 131) 6-8 × 5-6 μ, warts 0.1 μ or less in height, isolated or with a few fine lines. *Pleurocystidia* 48-85 × 6-10 μ, fusoid to subclavate, rounded or appendiculate, granular or banded; *cheilocystidia* 43-50 × 6-7 μ, clavate, at times constricted, rounded or appendiculate, granular or empty. *Epicutis* (Fig. 243) composed of a turf of hyphae which are more or less constricted to irregular, subulate or flask-shaped, each with a basal cell, the turf resting on a bed of pseudoparenchyma,—a *virescens*-type of epicutis. *R. rimosa*

Murr. agrees with *R rosei-isabellina* Murr. in essential respects, and therefore the former is reduced to synonymy. (No studies reported by Singer.)

R. rosei-isabellina Murr., Lloydia 6: 216. 1943. *Spores* (Fig. 74) 6-8 × 5-6 μ, warts less than 0.1 μ high, at times the wall appearing nearly smooth, isolated, with a few indistinct fine lines. *Pleurocystidia* 45-76 × 4-10 μ, ventricose, at times constricted, rounded or appendiculate, granular or banded; *cheilocystidia* 41-48 × 5-7 μ, clavate to ventricose, rounded or appendiculate, granular or empty. *Epicutis* (Fig. 308) composed of a turf of erect, more or less subulate hyphae, each with a basal cell, the turf resting on a bed of pseudoparenchyma,—a *virescens*-type of epicutis. (No studies reported by Singer.)

R. roseitincta Murr., Torrey Bot. Club Bull. 67: 278. 1940. *Spores* (Fig. 144) 8-10 × 7-8 μ, warts 0.6-1.0 μ high, isolated or with some indistinct fine lines. *Epicutis* (Fig. 241) composed of ascendant or erect hyphae which are variable: constricted, non-septate or septate, the apices rounded or acute; no *pilocystidia*. (Singer 1957: 211.)

R. rubrifolia Murr., Torrey Bot. Club Bull. 67: 232. 1940. *Spores* (Fig. 10) 8-10 × 7-8.5 μ, warts 0.4-0.8 (1.2) μ high, at times catenulate, broad bands and fine lines forming an incomplete reticulum. *Pleurocystidia* 60-88 × 6-11 μ, ventricose or clavate, at times irregular and slightly constricted, acute or appendiculate, empty or banded; *cheilocystidia* 48-54 × 2-7 μ, versiform (a filiform type numerous, some fusoid, others bottle-shaped), acute or appendiculate, empty, granular, or banded. *Epicutis* (Fig. 217) composed of erect or ascendant hyphae which are cylindric, subulate, capitate, or constricted; with clavate *pilocystidia*, and an occasional *oleiferous* hypha. (No studies reported by Singer.)

R. rubripurpurea Murr., Lloydia 6: 216. 1943. *Spores* (Fig. 50) 6.3-8 × 5-7.5 μ, warts usually 0.1 μ or less in height, at times 0.2-0.4 μ high, fine lines forming an incomplete reticulum. *Pleurocystidia* 50-62 × 5-10 μ, ventricose, acute or short-appendiculate, banded; *cheilocystidia* 40-50 × 5-6 μ, ventricose, clavate, or subcylindric, apices rounded or subcapitate, granular or banded. *Epicutis* (Fig. 204) composed of erect hyphae which are clavate, fusoid, at times constricted; no *pilocystidia*. (No studies reported by Singer.)

R. rugulosa Pk., New York State Mus. Ann. Rept. 54: 179. 1901. *Spores* (Fig. 56) 7-9 × 6-7 μ, warts 0.4-0.6 μ high, at times 0.1 μ or less, a few catenulate, with some fine lines. *Pleurocystidia* 46-66 × 6-8 (12) μ, clavate, ventricose, rounded or capitate, at times appendiculate, banded; *cheilocystidia* 38-45 × 5-7 μ, clavate, appendiculate, empty. *Epicutis* (Fig. 229) composed of a turf of hyphae which are cylindric, subclavate or subulate, at times nodulose; *pilocystidia* clavate, granular. (No studies reported by Singer.)

R. sericella Murr., Lloydia 7: 313. 1944. *Spores* (Fig. 77) 8-10 × 7-8 μ, warts 0.2-0.4 μ high, a few short-catenulate, many isolated, with some fine lines. *Pleurocystidia* 48-55 × 6-8 μ, inconspicuous, ventricose or fusoid, acute or appendiculate, granular or empty; *cheilocystidia* 33-48 × 5-6 μ, versiform (clavate, cylindric-capitate, at times constricted) empty or granular. (No studies reported by Singer.)

R. sericeonitens Kauff., Mich. Acad. Sci. Rept. 11: 84. 1909. *Spores* (Fig. 79) 8-9 × 6.3-7.5 μ, warts 0.9-1.2 μ high, isolated, rarely with one or two fine lines. *Epicutis* (Fig. 221) composed of a turf of erect to ascendant hyphae, which are cylindric to fusoid, the apices subulate or subcapitate; *pilocystidia* granular, more hyphoid in shape than cystidioid. (Singer 1957: 216.)

R. serissima Pk., New York State Mus. Bull. 139: 44. 1910. *Spores* (Fig. 92) 9-12 × (6.5) 8-10 μ, warts 0.6-1.2 μ high, numerous, mostly isolated, a few may be catenulate, and at times with a few indistinct fine lines. *Epicutis* (Fig. 212) composed of erect hyphae which tend to form tufts, the hyphae often irregularly nodulose, the apices rounded or acute; *pilocystidia* widely scattered, clavate. (Singer 1947: 78.)

R. simillima Pk., New York State Mus. Ann. Rept. 24: 275. 1872. *Spores* (Fig. 111) 7.5-9 × 6.3-7.5 μ, warts 0.1-0.2 μ high, or at times 0.5-0.7 μ high, fine lines forming a reticulum. *Epicutis* (Fig. 222) composed of slender, cylindric hyphae; *pilocystidia* clavate, granular or banded. (Singer 1939: 236.)

R. sordida Pk., Buffalo Soc. Nat. Sci. 1: 57. 1873. *Spores* (Fig. 116) 7.5-8.5 × 6-7.5 μ, warts 0.2 μ or less in height, some isolated, others with fine lines forming an incomplete reticulum. *Epicutis* (Fig. 180) not well developed; cuticle composed of repent hyphae beneath which the hyphae are loosely interwoven and nodulose; no *pilocystidia*. (Singer 1957: 149.)

R. subacris Murr., Torrey Bot. Club Bull. 67: 279. 1940. The following notes are based on a study of a specimen collected and identified by Murrill (Univ. Tenn. Herb. No. 16265): *Spores* (Fig. 126) 8-10.5 × 7-8.5 μ, warts 0.7-1.2 μ high, some catenulate, with a few to many fine lines forming a reticulum. *Epicutis* (Fig. 310) composed of loosely interwoven erect or ascendant hyphae which are cylindric; *pilocystidia* numerous, clavate or subcapitate, more or less granular. (Singer 1957: 232 lists this as a doubtful synonym of *R. emetica* ssp. *lacustris* Singer.)

R. subalbidula Murr., Mycologia 33: 441. 1941. *Spores* (Fig. 115) 8-10 × 7-8 μ, warts 0.6-1.0 μ high, some catenulate, others isolated, with a few fine lines. *Epicutis* (Fig. 164) composed of a turf of erect, slinder to broad hyphae, some with ventricose apices; *pilocystidia* slender-clavate, granular to banded. (Singer 1947: 174 says this is not distinguishable from a medium-sized form of *R. anomala* Pk., except that it is usually slightly acrid.)

R. subalutacea Burl., North American Flora 9: 227. 1915. *Spores* (Fig. 110) 9-12 × 7-9 μ, warts 0.6-1.2 μ high, isolated or with a few fine lines. *Pleurocystidia* 63-74 × 6-12 μ, fusoid or ventricose, at times more or less constricted, acute or appendiculate, banded, granular, or empty; *cheilocystidia* 42-70 × 5-10 μ, fusoid or ventricose, at times more or less constricted, acute or rounded, banded, granular, or empty. *Epicutis* (Fig. 230) composed of irregular to somewhat constricted hyphae, 2-5 μ broad, the apices rounded or acute; no *pilocystidia*. (No studies reported by Singer.)

R. subbrunneipes Murr., Florida Acad. Sci. Jour. 8: 182. 1945. *Spores* (Fig. 122) 8.5-10 × 7.5-9 μ, warts 0.7-1.2 μ high, some isolated, others catenulate, with some fine lines. *Pleurocystidia* 58-71 × 6-8 μ, ventricose,

appendiculate, the appendage often disposed at right angles to the long axis, empty or banded; *cheilocystidia* 42-60 × 3-7 μ, clavate, fusoid, cylindric, at times constricted, acute or appendiculate, the appendage at times disposed at right angles to the long axis, empty, granular, or banded. *Epicutis* (Fig. 220) composed of erect to ascendant hyphae, which are slender, the apices tapering or capitate; *pilocystidia* clavate, granular, numerous. (No studies reported by Singer.)

R. subcremeiceps Murr., Lloydia 8: 270. 1945. *Spores* (Fig. 8) 7.5-9 × 6-7 μ, warts 0.1 μ or less in height, many fine lines and some broad bands forming a reticulum. *Pleurocystidia* 55-71 × 6-10 μ, ventricose, appendiculate or capitate, granular or banded; *cheilocystidia* 42-57 × 5-10 μ, ventricose, usually long- or short-appendiculate, banded. *Epicutis* (Fig. 312) composed of more or less nodulose hyphae, the apices tapering or appendiculate; *pilocystidia* clavate, scattered, granular. (No studies reported by Singer.)

R. subdensifolia Murr., Mycologia 33: 441. 1941. The following notes are based on a study of an authentic specimen, No. F 18583, collected and determined by Murrill: *Spores* (Fig. 32) 8.5-10 × 7-8.5 μ, warts 0.7-1.3 μ high, isolated, no fine lines and no bands. *Epicutis* (Fig. 165) composed of a turf of erect, more or less constricted hyphae; *pilocystidia* numerous, clavate, granular to banded. (Singer 1957: 152.)

R. subdepallens Pk., Torrey Bot. Club Bull. 23: 412. 1896. *Spores* (Fig. 20) 8-10 × 7-8.5 μ, warts blunt, stout, 0.6-1.0 μ high, isolated, at times with broad bands. *Pleurocystidia* 50-98 × 6-10 μ, buried or projecting, fusoid to clavate, apices appendiculate, acute, rounded, or capitate; *cheilocystidia* 32-50 × 6-7 μ, fusoid, clavate, acute, appendiculate, or rounded. *Epicutis* (Fig. 231) composed of a zone of gelatinous hyphae with some erect free ends, the apices often acute; no *pilocystidia* found. (No studies reported by Singer.)

R. subflava Murr., Mycologia 33: 442. 1941. *Spores* (Fig. 39) 8-10 × 6-8 μ, warts 0.1-0.3 μ high, fine lines and ridges forming a reticulum. *Pleurocystidia* 48-61 × 7-9 μ, clavate or ventricose, acute to mucronate, granular or banded; *cheilocystidia* 37-43 × 6-10 μ, clavate or ventricose, mucronate, empty or granular. *Epicutis* (Fig. 163) composed of a turf of slender hyphae, which are cylindric to constricted, the apices often acute; *pilocystidia* rather inconspicuous, clavate to spathulate, granular or empty. This species is, of course, not the same as *R. subflava* Singer which Singer, 1957: 152, now places in synonymy with *R. subdensifolia* Murr. (No studies reported by Singer.)

R. subfloridana Murr., Lloydia 8: 271. 1945. *Spores* (Fig. 95) 8-11 × 7-8.5 μ, warts 0.7-1.2 μ high, isolated or short-cantenulate, with some fine lines. *Epicutis* (Fig. 302) composed of a turf of hyphae which are irregularly constricted, some hyphae broad, septate; the apices rounded or acute; no *pilocystidia*. (Singer 1957: 212.)

R. subglauca Murr., Lloydia 6: 217. 1943. *Spores* (Fig. 73) 6.3-8.5 × 4.5-6.3 μ, warts 0.1 μ (rarely 0.2 μ) high, isolated or with a few fine lines. *Epicutis* (Fig. 303) composed of a turf of of septate-constricted hyphae, the terminal elements more or less tapering,—arising from a pseudoparen-

chymatous hypodermium,—the *virescens*-type. (Singer 1957: 194 lists this as a synonym of *R. chlorinosma* Burl.)

R. subgraminicolor Murr., Lloydia 6: 218. 1943. *Spores* (Fig. 157) 7-8.5 × 5.5-7 μ, warts 0.3-0.6 μ high, some isolated, some catenulate, some spores with fine lines. *Pleurocystidia* 46-71 × 5-7 μ, mostly near the lamellae-edges, fusoid to subcylindric, acute or mucronate, slightly granular to banded; *cheilocystidia* 34-44 × 5-8 μ, clavate to fusoid, few, absent in some sections. *Epicutis* (Feb. 313) composed of both narrow, non-septate hyphae, and broader, septate hyphae, the apices more or less acute; no *pilocystidia*. (No studies reported by Singer.)

R. subinconstans Murr., Mycologia 38: 226. 1946. *Spores* (Fig. 88) 6.5-9 × 5.7-7 μ, warts 0.3-0.7 μ high, some isolated, others catenulate, with some fine lines. *Epicutis* (Fig. 317) composed of hyphae which tend to be clavate; no *pilocystidia*. (Singer 1957: 203 lists *R. inconstans* Murr. as a synonym.)

R. subluteobasis Murr., Lloydia 6: 218. 1943. *Spores* (Fig. 47) 10-13 × 9-12 μ, warts 0.9-1.7 μ high, with short ridges and often indistinct fine lines, some isolated. *Epicutis* (Fig. 284) composed of loosely tangled hyphae; *pilocystidia* cylindric to obclavate, banded or with amorphous contents. (Singer 1957: 264.)

R. subobscura Murr., Torrey Bot. Club Bull. 66: 155. 1939. *Spores* (Fig. 136) 8-10.5 × 7-8.2 μ, warts 0.5-1.2 μ high, isolated, at times short-catenulate, no fine lines. *Epicutis* (Fig. 168) composed of a turf of somewhat constricted hyphae, the apices rounded or acute; *pilocystidia* clavate to ventricose, at times subcapitate, granular to banded. (Singer 1957: 153.)

R. subochroleuca Murr., Mycologia 30: 363. 1938. *Spores* (Fig. 154) 8-10 × 6.5-8 μ, warts usually less than 0.1 μ high, with fine lines and some broad bands. *Epicutis* (Fig. 187) composed of a turf of hyphae; no *pilocystidia*. (Singer 1957: 191 lists this as a synonym of *R. ochroleucoides* Kauff.)

R. subochrophylla Murr., Mycologia 30: 364. 1938. *Spores* (Fig. 155) 8-10 × 5.5-7.5 μ, warts 0.2-0.5 μ high, with some fine lines and broad bands. *Pleurocystidia* 51-62 × 8-10 μ, few and inconspicuous, ventricose, appendiculate, empty or granular; *cheilocystidia* 43-52 × 7-10 μ, clavate or ventricose, at times constricted, appendiculate, empty or banded. *Epicutis* (Fig. 261) composed of a loose turf of hyphae which are often irregularly constricted; no *pilocystidia*. (No studies reported by Singer.)

R. subpavonina Murr., Lloydia 8: 271. 1945. *Spores* (Fig. 17) 9-11 × 8-9 μ, warts numerous, cylindric, 0.8-1.2 μ high, some isolated, others catenulate, with a few fine lines. *Pleurocystidia* 50-74 × 8-11 μ, ventricose, mucronate, acute, or capitate, banded; *cheilocystidia* 52-61 × 7-9 μ, ventricose, acute to appendiculate-capitate, granular or banded. *Epicutis* (Fig. 219) composed of a loose turf of hyphae which are more or less constricted; *pilocystidia* clavate, granular to minutely banded. (No studies reported by Singer.)

R. subpruinosa Murr., Lloydia 7: 313. 1944. *Spores* (Fig. 15) 8-11 × 7-9 μ, warts 0.4-0.6 μ high, isolated, most of the spores with a few indistinct, fine lines. *Pleurocystidia* 41-56 × 6-11 μ, ventricose, fusoid, or

clavate, acute or appendiculate, empty or granular; *cheilocystidia* 37-52 × 7-12 μ, numerous, clustered, ventricose, acute or appendiculate, empty. *Epicutis* (Fig. 203) composed of a turf of hyphae which are cylindric to ventricose or constricted, the apices tapering or rounded. (No studies reported by Singer.)

R. subpusilla Murr., Mycologia 33: 285. 1941. *Spores* (Fig. 124) 7.5-9 × (6.3) 7-8 μ, warts 0.8-1.4 μ high, some isolated, a few fine lines and broad bands forming an incomplete reticulum. *Pleurocystidia* 48-60 × 6-9 μ, clavate, at times constricted, subcapitate, mucronate, or appendiculate, empty or banded; *cheilocystidia* 28-42 × 5-8 μ, cylindric to clavate, some mucronate, others rounded, granular or banded. *Epicutis* (Fig. 169) composed of a turf of more or less nodulose hyphae, the apices rounded, at times appendiculate; *pilocystidia* clavate, at times appendiculate, granular to banded. (No studies reported by Singer.)

R. subrubescens Murr., Torrey Bot. Club Bull. 67: 146. 1940. *Spores* (Fig. 108) 9-11 × 8-9.5 μ, warts 1.0-1.4 μ high, isolated to short-catenulate, no fine lines. *Pleurocystidia* 45-68 × (6) 8-12 μ, fusoid or clavate, at times appendiculate or mucronate, empty, granular or banded; *cheilocystidia* 28-51 × 4-7 μ, cylindric, clavate, or ventricose, empty, granular, or minutely banded. *Epicutis* (Fig. 170) composed of a turf of hyphae which are cylindric to nodulose-constricted; *pilocystidia* clavate, the apices acute or rounded, minutely banded. (No studies reported by Singer.)

R. subsericeonitens Murr., Torrey Bot. Club Bull. 66: 156. 1939. *Spores* (Fig. 117) 8-9.5 × 7.5-8 μ, warts 0.6-1.0 μ high, usually broad and blunt, isolated or with a few fine lines. *Epicutis* (Fig. 215) composed of slender, clavate hyphae, the apices rounded; *pilocystidia* numerous, slender-clavate, granular. (Singer 1957: 151.)

R. subsordida Pk., New York State Mus. Bull. 105: 40. 1906. *Spores* (Fig. 76) 7-8.5 × 5.6-7 μ, warts 0.2 μ high or less, some isolated, with a few short ridges and fine lines. *Epicutis* (Fig. 246) not differentiated or only slightly so; the *cuticle* composed of repent surface hyphae, or with a few more or less erect hyphae; most of the hyphae beneath surface with inflated cells; no *pilocystidia*. It appears that *R. subsordida* Pk. is a synonym of *R. sordida* Pk. which in turn is a synonym of *R. albonigra* (Kromb.) Fr. (For studies on *R. albonigra*, see Singer 1957: 149.)

R. subsulphurea Murr., Florida Acad. Sci. Jour. 8: 183. 1945. *Spores* (Fig. 159) 7-8.5 × 5.7-7 μ, warts 0.1-0.3 μ high, broad bands and fine lines forming a reticulum. *Pleurocystidia* 48-76 × 4-7 (11) μ, fusoid, ventricose, or cylindric, acute or appendiculate, empty or banded; *cheilocystidia* 38-53 × 4-8 μ, fusoid or cylindric, apex rounded, acute, or appendiculate. *Epicutis* (Fig. 314) composed of erect to ascendant hyphae which are more or less nodulose-constricted, the apices acute; no *pilocystidia*. (No studies reported by Singer.)

R. subvariata Murr., Lloydia 7: 314. 1944. *Spores* (Fig. 89) 8-10.5 × 7-9 μ, warts 0.9-1.3 μ high, isolated or with a few fine lines which at times form an incomplete reticulum. *Pleurocystidia* 60-73 × 9-11 μ, ventricose, capitate or button-like, or appendiculate, granular or banded; *cheilocystidia* 40-50 × 7-9 μ, ventricose, acute or appendiculate, granular or banded. *Epicutis* (Fig. 167) composed of erect or ascendant hyphae which are cylindric to nodulose-constricted, the apices at times appendicu-

late; *pilocystidia* numerous, cylindric to nodulose-constricted, granular, the apices acute, rounded, or subcapitate. (No studies reported by Singer.)

R. tennesseensis Singer, Soc. Myc. Fr. Bull. 55: 229. 1939. The following notes are based on a study of University of Tennessee collection No. 11496, a part of the collection sent by the writer to Singer: *Spores* (Fig. 59) 6-8 × 7.3-7 μ, warts 0.4-0.5 μ high, a few catenulate, both fine lines and broad bands forming a reticuum. *Epicutis* (Fig. 178) composed of erect to repent brownish hyphae, with a few lactifers; the *hypodermium* composed of a lattice of narrow hyphae. No *pilocystidia*. (Singer 1939: 229.)

R. tenuiceps Kauff., Mich. Acad. Sci. Rept. 11: 81. 1909. *Spores* (Fig. 71) 8-9.5 × 6.3-8 μ, warts 0.5-0.8 μ high, some isolated, others catenulate, with a few fine lines forming a reticulum. *Epicutis* (Fig. 226) composed of nodulose-constricted to cylindric hyphae, the apices rounded or acute; *pilocystidia* rather numerous, slender to broadly clavate, minutely banded. (Singer 1957: 259.)

R. testaceiceps Murr., Lloydia 8: 272. 1945. *Spores* (Fig. 138) 7-8.5 × 6-7 μ, warts 0.4-0.8 μ high, isolated, with some fine lines. *Epicutis* (Fig. 166) composed of a turf of cylindric to nodulose-constricted hyphae, the apices rounded to appendiculate; *pilocystidia* few, inconspicuous, clavate, only slightly granular. (Singer 1957: 262 lists this as a synonym of *R. praefragilis* Murr., but there are differences in the epicutis of the types.)

R. tuberculata Murr., Torrey Bot. Club Bull. 67: 58. 1940. *Spores* (Fig. 24) 8.5-12 × 8-10 μ, warts 0.8-1.5 μ high, stout, several broad bands and a few fine lines forming a reticulum. *Epicutis* (Fig. 205) composed of scattered hyphae of two types: (1) slender, constricted, non-septate, and (2) strongly constricted, septate, broader hyphae,—at times appearing as a chain of elements, the apices somewhat acute; no *pilocystidia*. (Singer 1957: 187.)

R. uncialis Pk., New York State Mus. Bull. 1 (No. 2): 10. 1887. *Spores* (Fig. 139) 7.5-9 × 5.5-7 μ, warts mostly 1.0 μ or less in height, occasionally up to 0.3 μ high, at times short-catenulate, often isolated, a few fine lines. *Pleurocystidia* 66-90 × 7-9 μ, clavate to ventricose, at times constricted, acute to subcapitate, at times mucronate, banded: *cheilocystidia* 36-52 × 7-9 μ, ventricose, acute, mucronate, or appendiculate, banded or empty. *Epicutis* (Fig. 269) composed of a turf of irregular, often nodulose hyphae, arising from a hypodermium which is apparently pseudoparenchymatic, approaching the *virescens*-type. (No studies reported by Singer.)

R. uncialiformis Murr., Lloydia 6: 219. 1943. *Spores* (Fig. 99) 8-10 × 7-8.5 μ, warts 0.8-1.3 μ high, some isolated, some catenulate, with some fine lines. *Pleurocystidia* 36-63 × 5-9 μ, clavate or obclavate, mucronate, empty; *cheilocystidia* 38-50 × 6-10 μ, clavate, ventricose, mucronate, empty. *Epicutis* (Fig. 216) composed of erect, more or less nodulose hyphae, the apices at times slightly appendiculate; *pilocystidia* several to numerous, few or none in oldest carpophores. (No studies reported by Singer.)

R. variata Bann., Bot. Gaz. 5: 165. 1881. The following notes are based on a study of specimens marked "type," but there is now a note written by a later hand that the collection is not acceptable as the type: *Spores* (Fig. 37) 8-10 (12) × 6-9 μ, often more or less inequilateral, warts acute and slender, 0.4-1.0 μ high, isolated or catenulate, at times with fine

lines. *Epicutis* (Fig. 298) composed of erect or ascendant hyphae, cylindric to fusoid, at times appendiculate; *pilocystidia*-like elements present, granular or banded. (Singer 1957: 170.)

R. variegata Singer, Sydowia 11: 185. 1957. *Spores* (Fig. 151) 6.3-8.5 × 5-6.5 μ, warts 0.3-0.6 μ high, with broad bands and fine lines forming a partial reticulum. *Epicutis* (Fig. 211) composed of septate-constricted hyphae in pyramidal tufts, the terminal elements acute or rounded, the basal elements appearing as a chain of cells; between the tufts the surface hyphae are repent. *Pilocystidia* none.

R. variicolor Murr., Lloydia 6: 219. 1943. *Spores* (Fig. 158) 7-9 × 6.3-8 μ, warts 0.8-1.0 μ high, isolated, some broad bands and fine lines forming an incomplete reticulum. *Epicutis* (Fig. 287) composed of a trichodermial septate hyphae, some terminal elements rounded, others acute, at times the basal elements as sphaerocysts; no *pilocystidia*. (Singer 1957: 189.)

R. ventricosipes Pk., Torrey Bot. Club Bull. 29: 70. 1902. *Spores* (Fig. 5) (6) 7-8 (11) × 4.5-6 μ, warts 0.1 μ or less in height, at times apparently absent, fine lines several, few, or none. *Epicutis* (Fig. 179) not differentiated; the cuticle composed of repent hyphae, or with an occasional erect hypha; some hyphae below the surface are cystidia-like. (Singer 1942: 69.)

R. venusta Murr., Lloydia 8: 272. 1945. *Spores* (Fig. 107) 7.5-11 × 7-9 μ, warts 0.7-1.2 μ high, isolated, at times short-catenulate. *Pleurocystidia* 45-96 × 7-10 μ, prominent, versiform: fusoid, ventricose, clavate, to cylindric, arising deep in the gill-trama, rounded or acute, at times capitate, or mucronate, granular or banded; *cheilocystidia* 37-76 × 7-10 μ, prominent, clavate-cylindric, or more rarely ventricose, empty, granular, or banded. *Epicutis* (Fig. 171) composed of a turf of numerous slender hyphae, the apices usually acute; *pilocystidia* clavate, often pale yellowish, granular to minutely banded. (No studies reported by Singer.)

R. vesicatoria Burl., Mycologia 36: 118. 1944. *Spores* (Fig. 93) 7.5-10 × 6-8 μ, warts 0.4-0.7 μ high, isolated or catenulate, fine lines forming an incomplete reticulum. *Epicutis* (Fig. 208) composed of a palisade of slender hyphae, and some scattered hyphae; with occasional buried *pilocystidia*. (Singer 1957: 145.)

R. vinacea Burl., North American Flora 9: 217. 1915. The following notes are based on a specimen, No. 97-1912, determined by Burlingham: *Spores* (Fig. 11) 9-10.5 × 7.5-9 μ, warts 0.9-1.2 μ high, isolated or short-catenulate, fine lines forming a more or less complete reticulum. *Epicutis* (Fig. 213) composed of erect hyphae which are cylindric, clavate, or subfusoid, the apices rounded or subacute; *pilocystidia* clavate, banded, conspicuous. (Singer 1942: 83.)

R. vinosirosea Murr., Lloydia 6: 219. 1943. *Spores* (Fig. 148) 7-9 × 5.7-7.5 μ, warts 0.3-0.5 μ high, isolated, at times catenulate, many spores with fine lines which form an incomplete reticulum. *Pleurocystidia* scattered, 38-50 × 6-7 μ, ventricose to fusoid, appendiculate, empty, granular, or banded; *cheilocystidia* 30-43 × 5-9 μ, few, ventricose, appendiculate or mucronate, empty or granular. *Epicutis* (Fig. 316) composed of loosely-disposed, erect, somewhat nodulose hyphae, the apices acute; *pilocystidia* cylindric to constricted, or subfusoid. (No studies reported by Singer.)

R. viridella Pk., New York State Mus. Bull. 105: 41. 1906. *Spores* (Fig. 133) 6-7.2 × 5-5.8 μ, warts 0.2-0.3 μ high, with a few fine lines not forming a complete reticulum. *Epicutis* (Fig. 227) composed of cylindric to nodulose hyphae, the apices rounded or slightly acute; *pilocystidia* cylindric, ventricose, or constricted, at times appendiculate, minutely banded to nearly empty; the epicuticular hyphae and pilocystidia occur at intervals as mounds over the lepidote surface, and between these mounds the cuticular hyphae are repent. (Singer 1942: 72.)

R. watsoniana Murr., Torrey Bot. Club Bull. 66: 156. 1939. *Spores* (Fig. 18) 9-12 × 7-8.5 μ, warts 0.8-1.3 μ high, isolated or catenulate, with a few fine lines. *Pleurocystidia* 61-96 × 6-12 μ, numerous, conspicuous, ventricose to irregularly-cylindric or constricted, apices acute or appendiculate, granular or banded; *cheilocystidia* few, 42-50 × 5-8 μ, ventricose to subcylindric, acute or appendiculate, granular. *Epicutis* (Fig. 191) not well developed; the cuticle composed of repent hyphae with scattered, at times numerous, ascendant or erect hyphae, the apices rounded to subcapitate, or acute; no *pilocystidia*. (No studies reported by Singer.)

R. westii Murr., Mycologia 33: 443. 1941. *Spores* (Fig. 4) 7-9 × 5-6.3 μ, warts rarely more than 0.1 μ high, often mere punctations, at times catenulate, with a few fine lines. *Epicutis* (Fig. 192) composed of cylindric to nodulose, erect hyphae; no *pilocystidia*. (Singer 1957: 199 reports findings ornamentations up to 0.7 μ high.)

R. xerampelina var. **semirubra** Singer, Sydowia 11: 218. 1957. The following notes are based on an authentic specimen determined by Singer, collected near West Roxbury, Massachusetts, August 30, 1945: *Spores* (Fig. 19) 9-11 × 7-9 μ, warts 0.8-1.6 μ high, isolated, with a few fine lines. *Epicutis* (Fig. 305) composed of hyphal tufts, the hyphae slender-cylindric or broad and the terminal elements subulate; *pilocystidia* clavate, granular.

Literature Cited

Burlingham, Gertrude S. 1924. Notes on species of *Russula*. Mycologia **16**: 16-23.

———. 1936. New or noteworthy species of *Russula* and *Lactarius*. Mycologia **28**: 253-267.

———. 1939. Two new species of *Russula* together with the spore ornamentation of some of our American *Russulas*. Mycologia **31**: 490-498.

———. 1942. Spore ornamentation of some American *Russulae* and a new species of *Lactaria*. Mycologia **34**: 8-12.

———. 1944. Studies in North American *Russulae*. Mycologia **36**: 104-120.

Crawshay, R. 1930. The Spore Ornamentation of the *Russulas*, pp. 5-179. London.

Kühner, Robert et Henri Romagnesi. 1953. Flore Analytique des Champignons Supérieurs. *Russula* Persoon, pp. 436-471.

Schaeffer, Julius. 1933-34. *Russula*-Monographie. Annales Mycologici **31**: 305-516; **32**: 141-243. (Reprint, 1952.)

Singer, R. 1939. Contribution a l'étude des Russules. Bull, Soc. Myc. Fr. **55**: 226-283.

———. 1942. Type studies on Basidiomycetes. I. Mycologia **34**: 64-93.

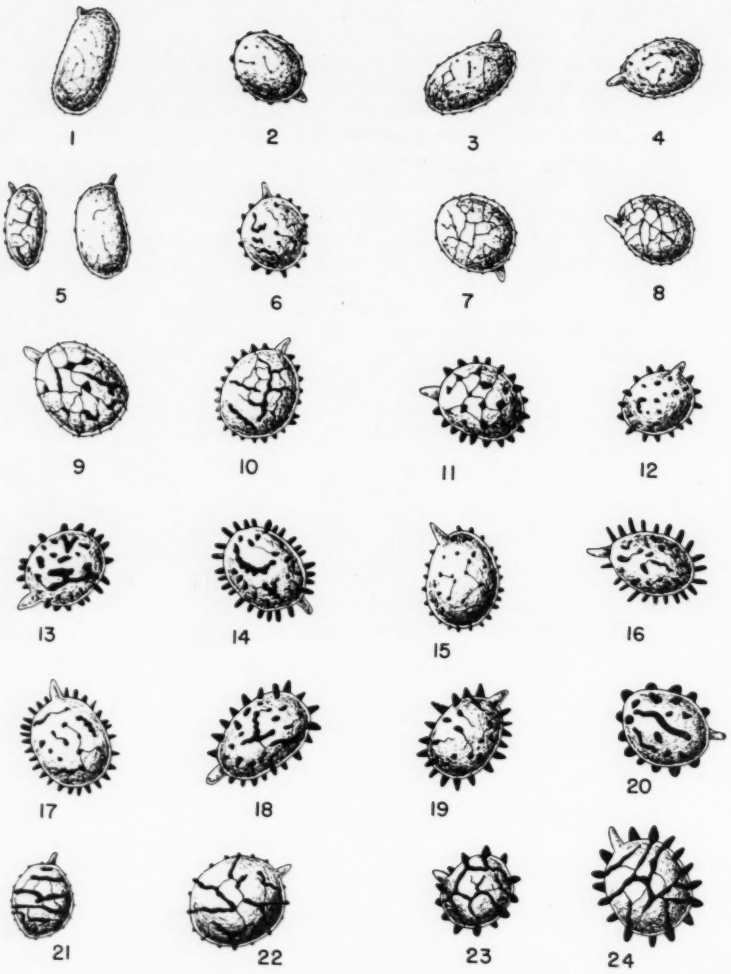
———. 1943. Type studies on Basidiomycetes. II. Mycologia **35**: 142-163.

———. 1945. New and interesting species of Basidiomycetes. Mycologia **37**: 425-439.

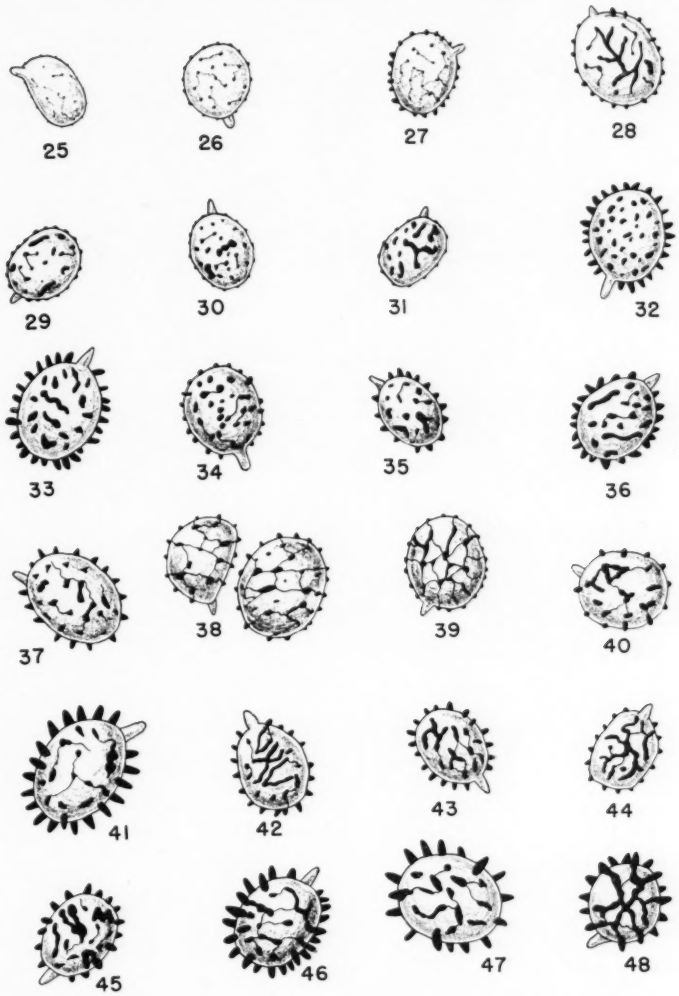
———. 1947. Type studies on Basidiomycetes. III. Mycologia **39**: 171-189.

———. 1948. New and interesting species of Basidiomycetes. II. Papers Mich. Acad. Sci., Arts, and Letters **32**: 103-150.

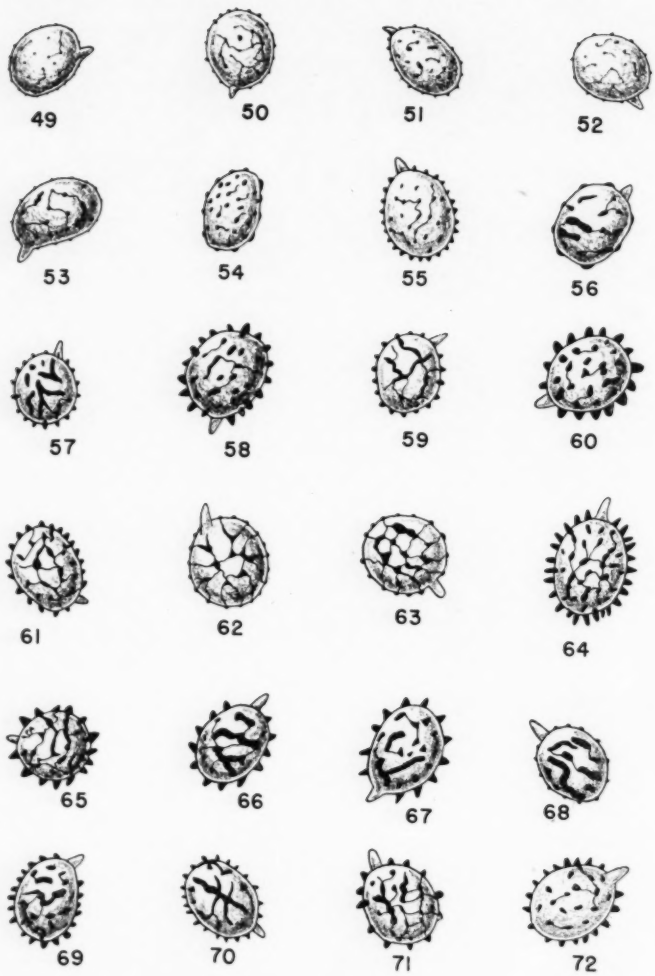
———. 1950a. Type studies on Basidiomycetes. IV. Lilloa **23**: 147-246.
———. 1950b. New and interesting species of Basidiomycetes. III. Sydowia **4**: 130-157.
———. 1951a. Type studies on agarics. III. Lilloa **25**: 463-514.
———. 1951b. Type studies on Basidiomycetes. V. Sydowia **5**: 445-475.
———. 1953. Type studies on Basidiomycetes. VI. Lilloa **26**: 57-159.
———. 1955. Type studies on Basidiomycetes. VIII. Sydowia **9**: 367-431.
———. 1957. New and interesting species of Basidiomycetes. V. Sydowia **11**: 141-272.
Smith, Alexander H. 1949. Mushrooms in Their Natural Habitats, pp. 275-282.



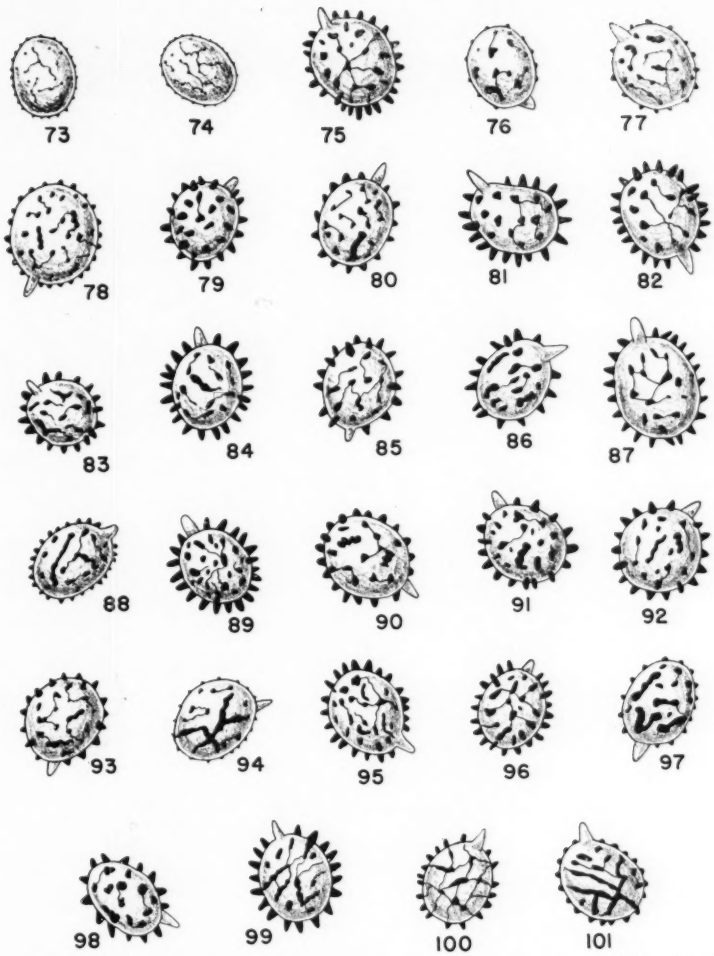
Russula spores: Fig. 1. *heterospora* Beards., 2. *affinis* Burl., 3. *beardslei* Burl., 4. *westii* Murr., 5. *ventricosipes* Pk., 6. *admirabilis* Burl., 7. *burkei* Burl., 8. *subcremeiceps* Murr., 9. *ochroleucoides* Kauff., 10. *rubrifolia* Murr., 11. *vinacea* Burl., 12. *leucomodesta* Sing., 13. *albiflavescens* Murr., 14. *albiclavipes* Murr., 15. *subpruinosa* Murr., 16. *perplexa* Burl., 17. *subpavonina* Murr., 18. *watsoniana* Murr., 19. *xerampelina* var. *semirubra* Sing., 20. *subdepallens* Pk., 21. *ochroleuciformis* Murr., 22. *magna* Beards., 23. *alachuana* Murr., 24. *tuberculata* Murr.



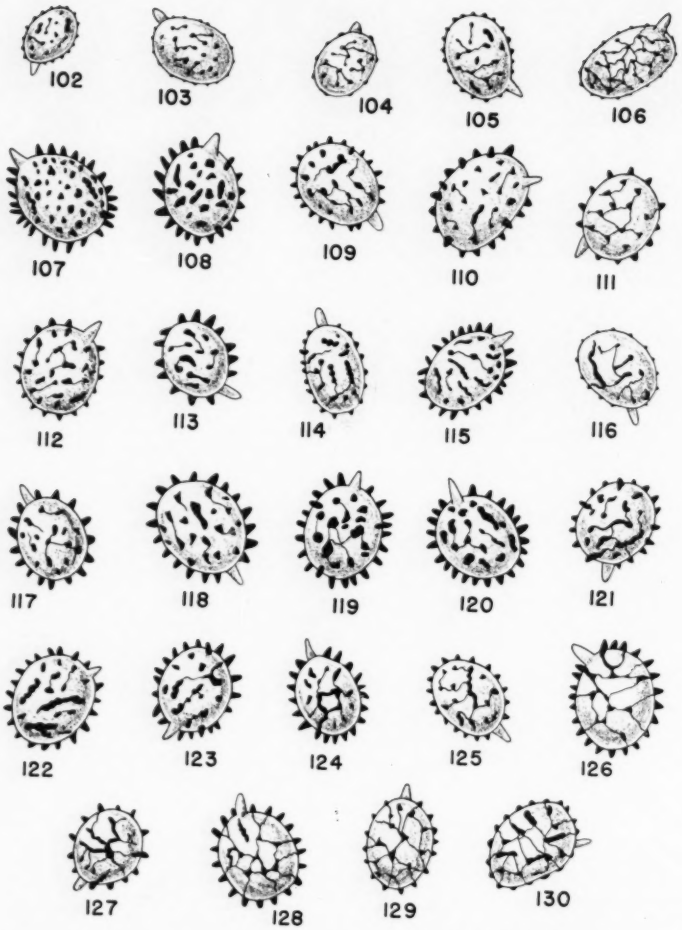
Russula spores: Fig. 25. *heterosporoides* Murr., 26. *albiduliformis* Murr., 27. *appalachiensis* Sing., 28. *inedulis* Murr., 29. *crustosa* Pk., 30. *brunneola* Burl., 31. *basifurcata* Pk., 32. *subdensifolia* Murr., 33. *arnoldae* Murr., 34. *ferrotincta* Sing., 35. *granulata* Pk., 36. *anomala* Pk., 37. *variata* Bann., 38. *balloui* Pk., 39. *subflava* Murr., 40. *blackfordae* Pk., 41. *hixsoni* Murr., 42. *australirosea* Murr., 43. *alutaceiformis* Murr., 44. *luteispora* Murr., 45. *amygdaloides* Kauff., 46. *cystidiosa* Murr., 47. *subluteobasis* Murr., 48. *granulosula* Murr.



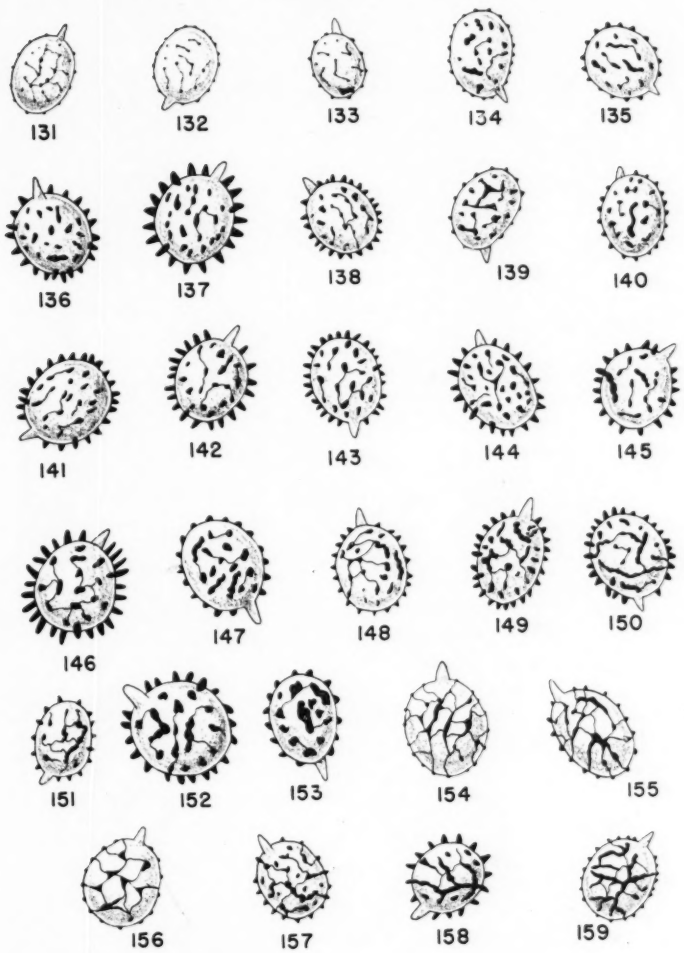
Russula spores: Fig. 49. *chlorinosma* Burl., 50. *rubripurpurea* Murr., 51. *glauca* Burl., 52. *flocculosa* Burl., 53. *novispora* Murr., 54. *magnifica* Pk., 55. *pseudofoetens* Murr., 56. *rugulosa* Pk., 57. *albidicremea* Murr., 58. *aurantialutea* Kauff., 59. *tennesseensis* Sing., 60. *mutabilis* Murr., 61. *pectinatoides* Pk., 62. *lutescentifolia* Murr., 63. *compacta* Frost & Pk., 64. *incarnaticeps* Murr., 65. *mariae* Pk., 66. *luteobasis* Pk., 67. *foetentula* Pk., 68. *flavida* Pk., 69. *albella* Pk., 70. *nigrescentipes* Pk., 71. *tenuiceps* Kauff., 72. *pseudolepida* Sing.



Russula spores: Fig. 73. *subglauca* Murr., 74. *rosei-isabellina* Murr., 75. *emeticiformis* Murr., 76. *subsordida* Pk., 77. *sericella* Murr., 78. *patriotica* Murr., 79. *sericeonitens* Kauff., 80. *palustris* Pk., 81. *pinetorum* Murr., 82. *pinicola* Murr., 83. *glaucescentipes* Murr., 84. *furcatifolia* Murr., 85. *pulchra* Burl., 86. *mutantipes* Murr., 87. *regalis* Murr., 88. *subinconstans* Murr., 89. *subvariata* Murr., 90. *crataegorum* Murr., 91. *borealis* Kauff., 92. *serissima* Pk., 93. *vesicatoria* Burl., 94. *partirosea* Murr., 95. *subfloridana* Murr., 96. *albida* Pk., 97. *albidula* Pk., 98. *atropurpurea* Pk., 99. *uncialiformis* Murr., 100. *fragilioides* Murr., 101. *cremeirubra* Murr.



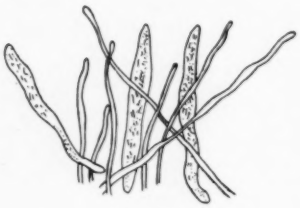
Russula spores: Fig. 102. *carlei* Pk., 103. *corallina* Burl., 104. *eccentrica* Pk., 105. *cinerascens* Beards., 106. *cremea* (Murr.) Sing., 107. *venusta* Murr., 108. *subrubescens* Murr., 109. *floridana* Murr., 110. *subalutacea* Burl., 111. *simillima* Pk., 112. *brunneipes* Murr., 113. *brevipes* Pk., 114. *anisata* Murr., 115. *subalbidula* Murr., 116. *sordida* Pk., 117. *subsericeonitens* Murr., 118. *pungens* Beards., 119. *praerubra* Murr., 120. *pinophila* Murr., 121. *diaboli* Sing., 122. *subbrunneipes* Murr., 123. *pusilliformis* Murr., 124. *subpusilla* Murr., 125. *pusilla* Pk., 126. *subacris* Murr., 127. *lividirosea* Murr., 128. *pervirginea* Murr., 129. *peckii* Sing., 130. *nigrodisca* Pk.



Russula spores: Fig. 131. *rimosa* Murr., 132. *maculosa* Murr., 133. *viridella* Pk., 134. *fosteriana* Murr., 135. *praetenuis* Murr., 136. *subobscura* Murr., 137. *cremeirosea* Murr., 138. *testaceiceps* Murr., 139. *uncialis* Pk., 140. *modesta* Pk., 141. *praerubriceps* Murr., 142. *praeclavipes* Murr., 143. *praecompacta* Murr., 144. *roseitincta* Murr., 145. *macropoda* Sing., 146. *perlactea* Murr., 147. *ochrophylla* Pk., 148. *vinosirosea* Murr., 149. *albimarginata* Murr., 150. *obscuriformis* Murr., 151. *variegata* Sing., 152. *levyana* Murr., 153. *flaviceps* Pk., 154. *subochroleuca* Murr., 155. *subochrophylla* Murr., 156. *levispora* Murr., 157. *subgraminicolor* Murr., 158. *variicolor* Murr., 159. *subsulphurea* Murr.

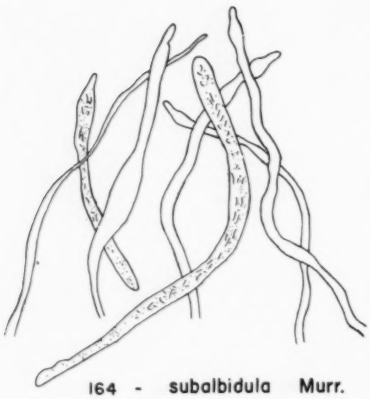
160 - praeclavipes Murr.

161 - praerubriceps Murr.

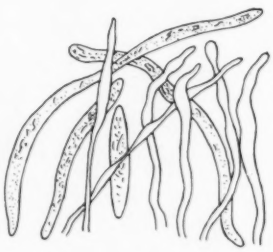


162 - pseudofoetens Murr.

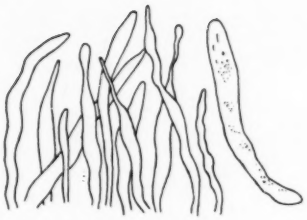
163 - subflava Murr.



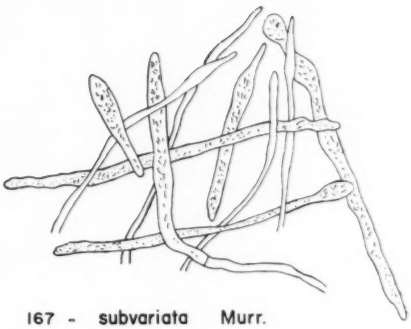
164 - subalbidula Murr.



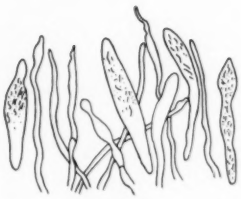
165 - subdensifolia Murr.



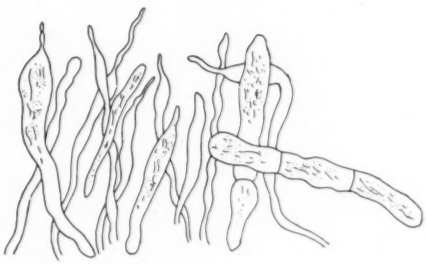
166 - testaceiceps Murr.



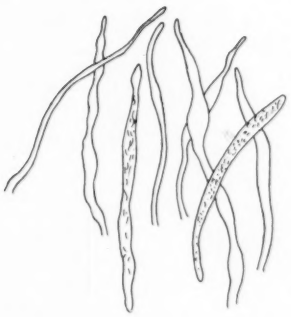
167 - subvariata Murr.



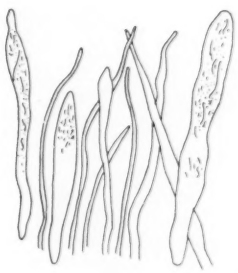
168 - subobscura Murr.



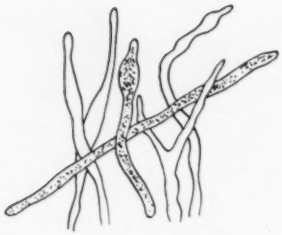
169 - subpusilla Murr.



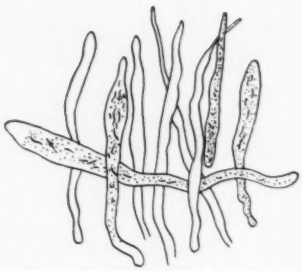
170 - subrubescens Murr.



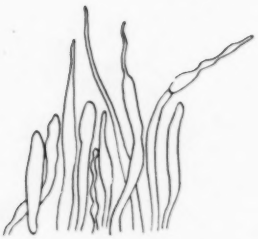
171 - venusta Murr.



172 - brunneipes Murr.

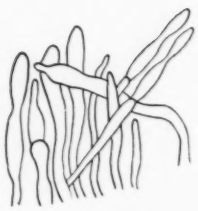


173 - fragilioides Murr.

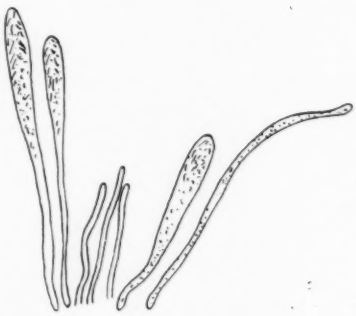


174 - lutescentifolia Murr.

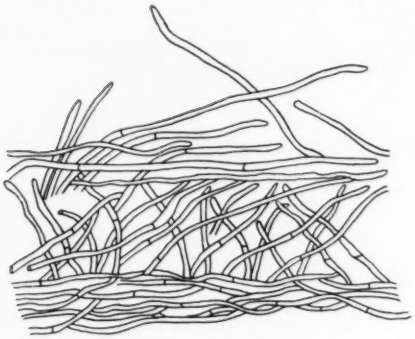
175 - heterosporoides Murr.



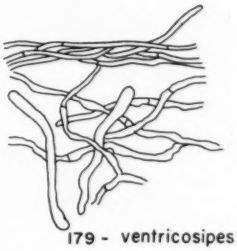
176 - levispora Murr.



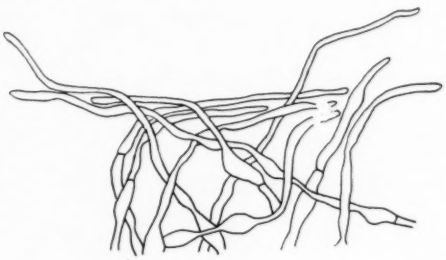
177 - partirosea Murr.



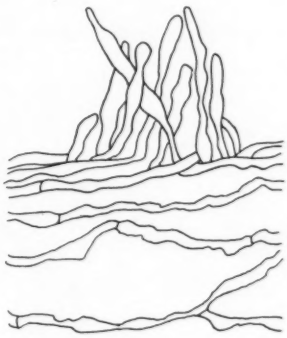
178 - tennesseensis Sing.



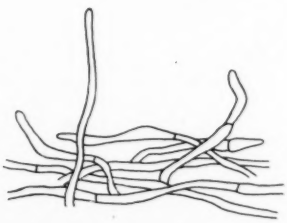
179 - ventricosipes Pk.



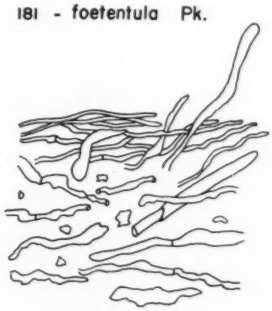
180 - sordida Pk.



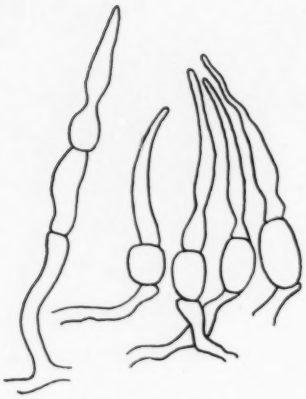
181 - foetentula Pk.



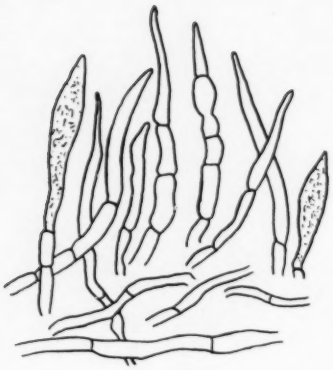
182 - eccentrica Pk.



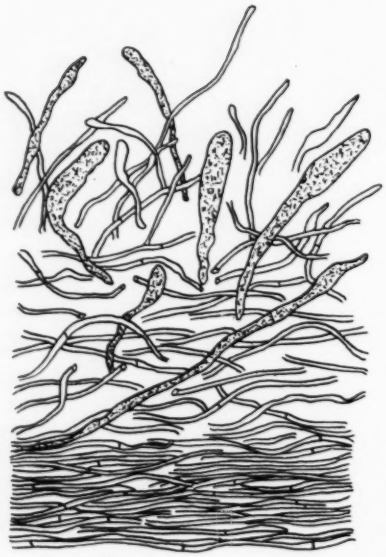
183 - heterospora Beards.



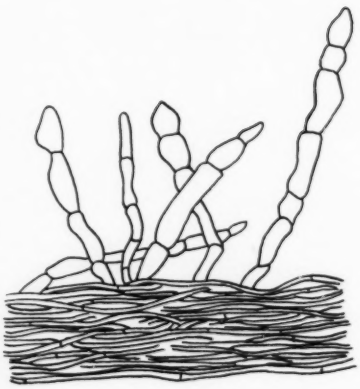
184 - alachuana Murr.



185 - affinis Burl.



a in youth

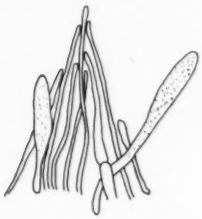


b in age

186 - albella Pk.

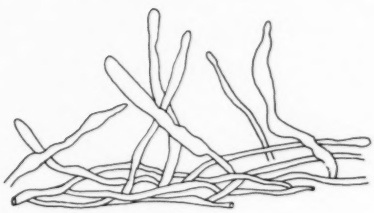
187 - subochroleuca Murr.

188 - ochroleucoides Kauff.

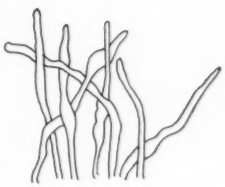


189 - floridana Murr.

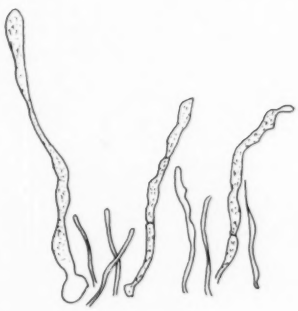
190 - ochroleuciformis Murr.



191 - watsoniana Murr.

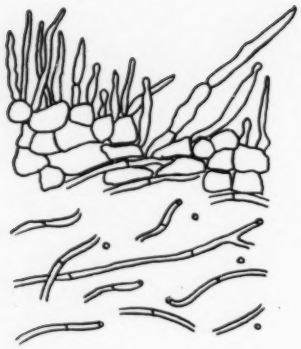


192 - westi Murr.

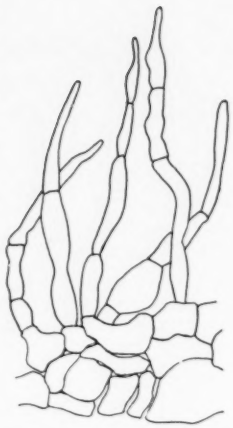


193 - anisata Murr.

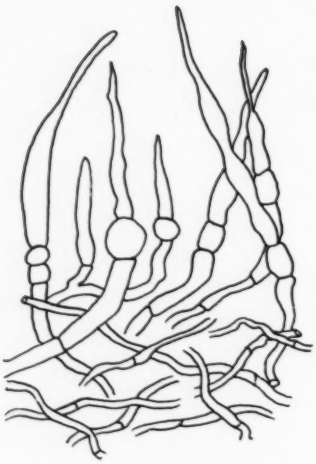
194 - mutabilis Murr.



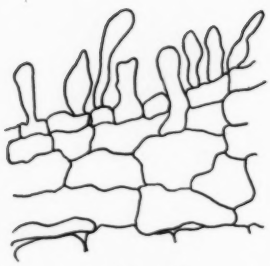
195 - crustosa Pk.



196 - chlorinosma Burl.

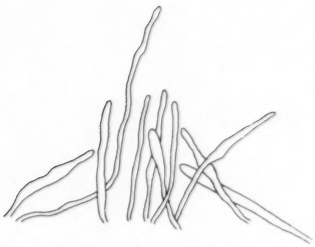


197 - mariae Pk.

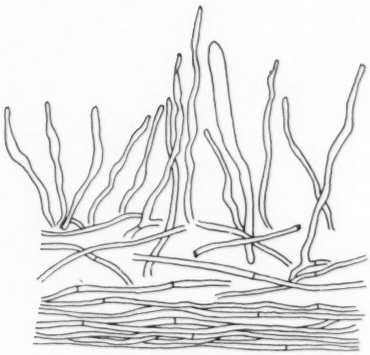


198 - albida Pk.

199 - hixsoni Murr.

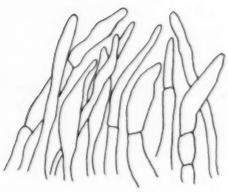


200 - albidicremea Murr.

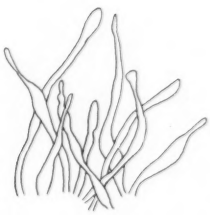


201 - albiclavipes Murr.

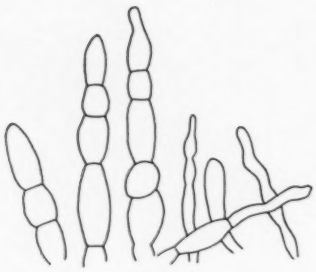
202 - glaucescentipes Murr.



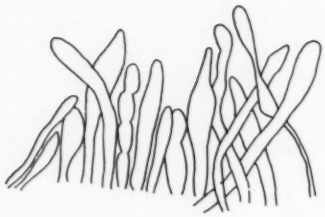
203 - subpruinosa Murr.



204 - rubripurpurea Murr.

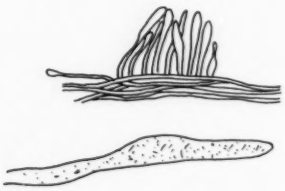


205 - tuberculata Murr.



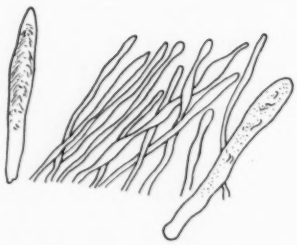
206 - praerubra Murr.

207 - peckii Sing.

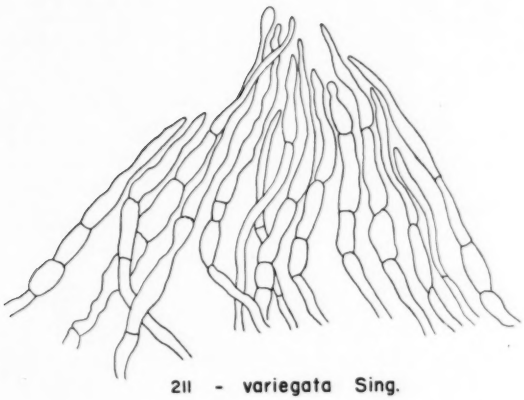


208 - vesicatoria Burl.

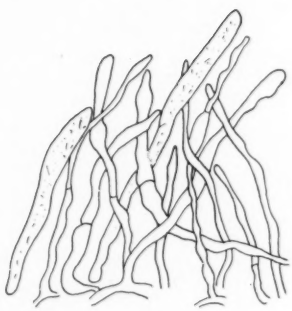
209 - emeticiformis Murr.



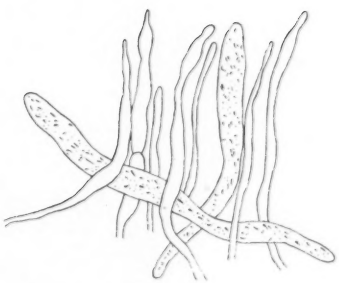
210 - macropoda Sing.



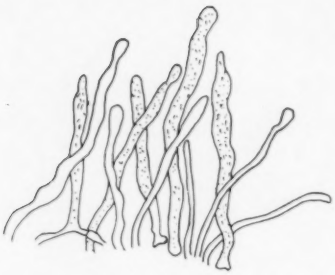
211 - variegata Sing.



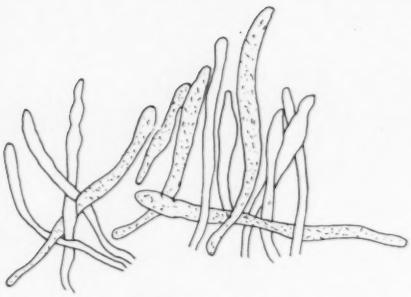
212 - serissima Pk.



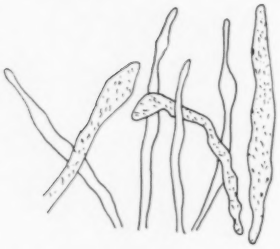
213 - vinacea Burl.



214 - furcatifolia Murr.

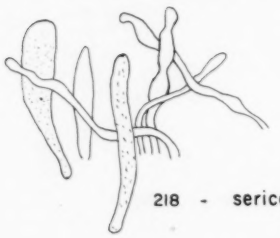


215 - subsericeonitens Murr.

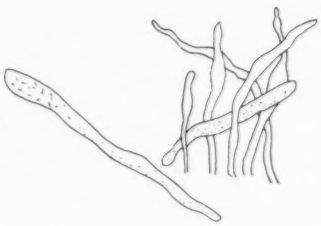


216 - uncialiformis Murr.

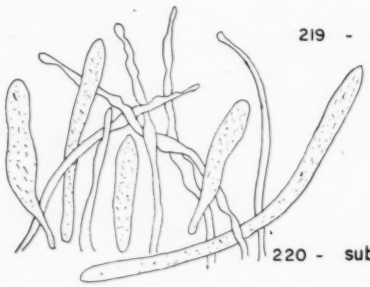
217 - rubrifolia Murr.



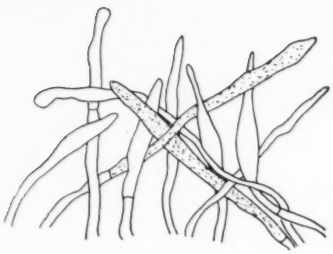
218 - sericella Murr.



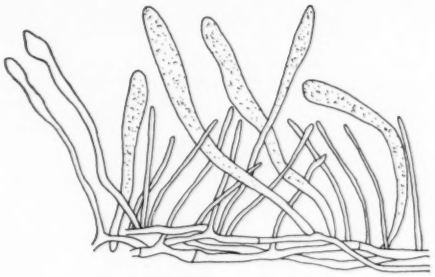
219 - subpavonina Murr.



220 - subbrunneipes Murr.

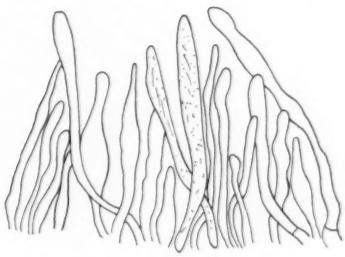


221 - sericeonitens Kauff.

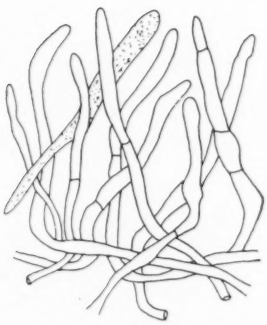


222 - simillima Pk.

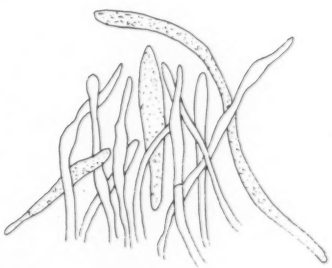
223 - pungens Beards.



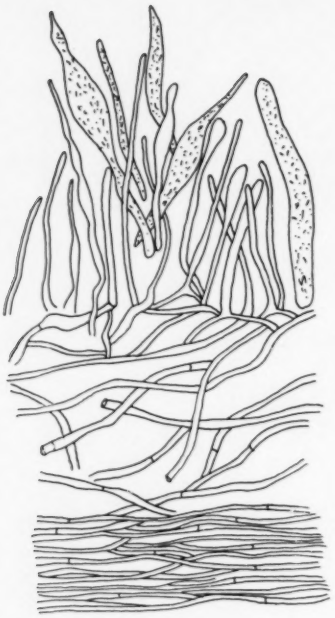
224 - magna Beards.



225 - pusilla Pk.

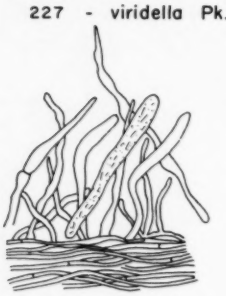


226 - tenuiceps Kauff.

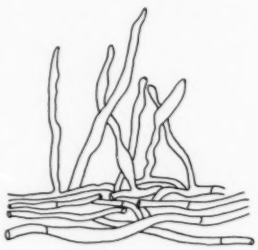


227 - viridella Pk.

228 - nigrodisca Pk.

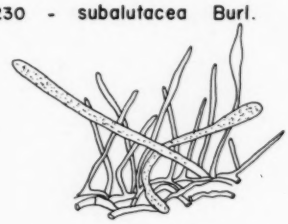


229 - rugulosa Pk.

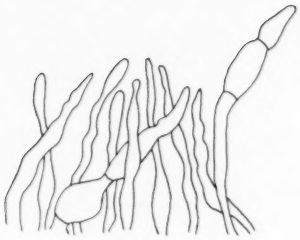


230 - subalutacea Burl.

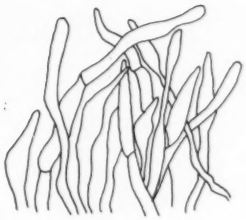
231 - subdepallens Pk.



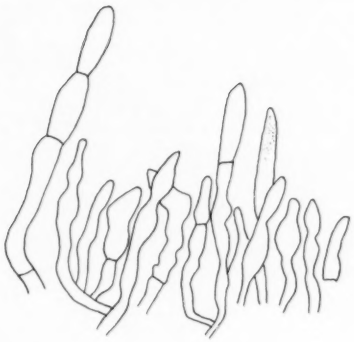
232 - palustris Pk.



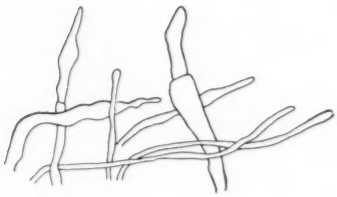
233 - crataegorum Murr.



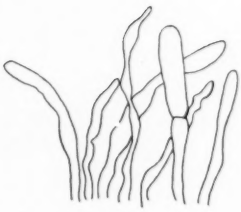
234 - borealis Kauff.



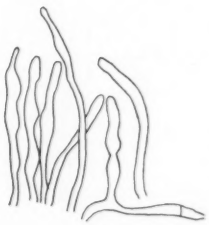
235 - amygdaloides Kauff.



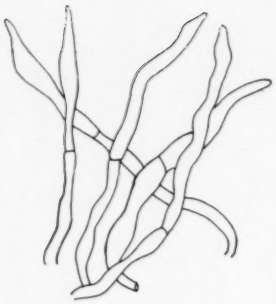
236 - cremeirubra Murr.



237 - cremeirosea Murr.

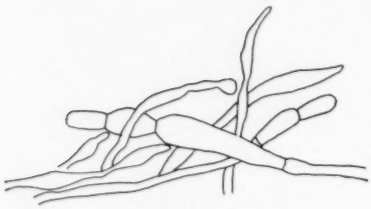


238 - ochrophylla Pk.

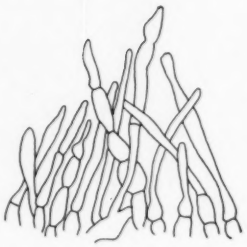


239 - corallina Burl.

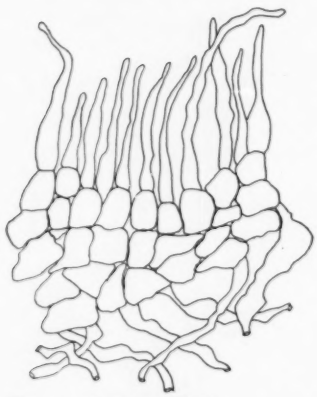
240 - glauca Burl.



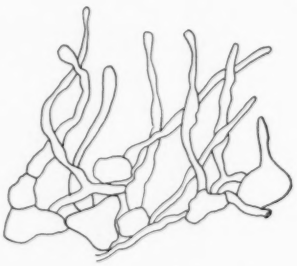
241 - roseitincta Murr.



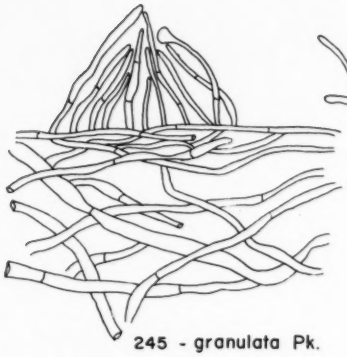
242 - mutantipes Murr.



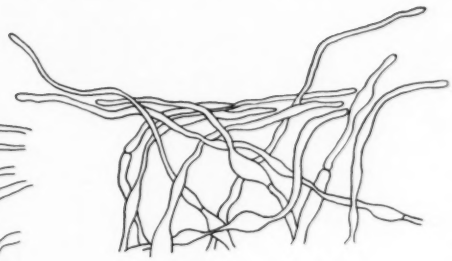
243 - rimosa Murr.



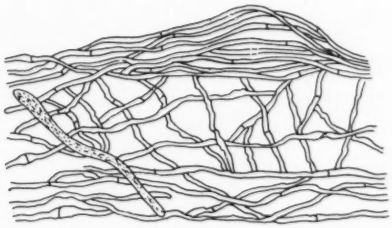
244 - praetenuis Murr.



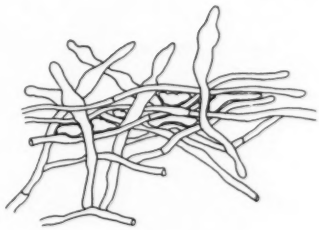
245 - granulata Pk.



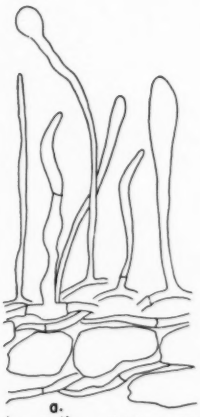
246 - subsordida Pk.



247 - balloui Pk.



248 - pulchra Burl.

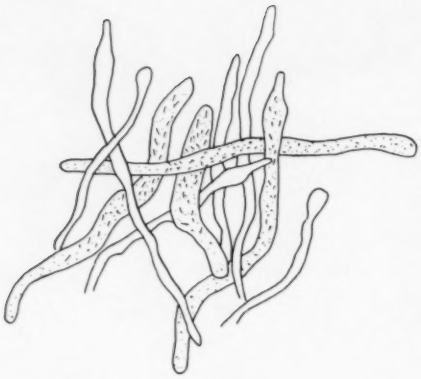


a. in youth

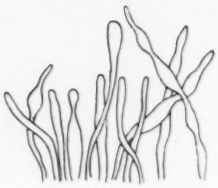
b. in age

249 - magnifica Pk.

250 - pectinatoides Pk.



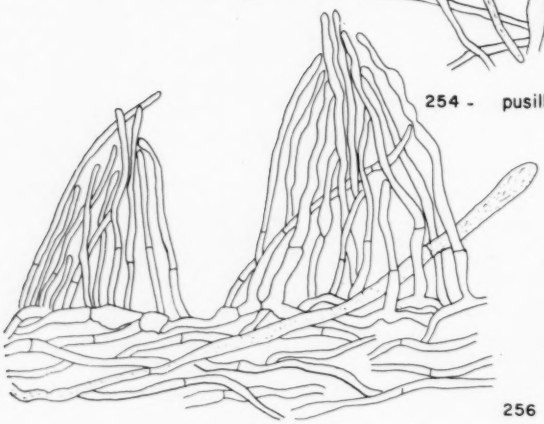
251 - anomala Pk.



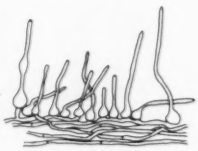
252 - albiduliformis Murr.

253 - brevipes Pk.

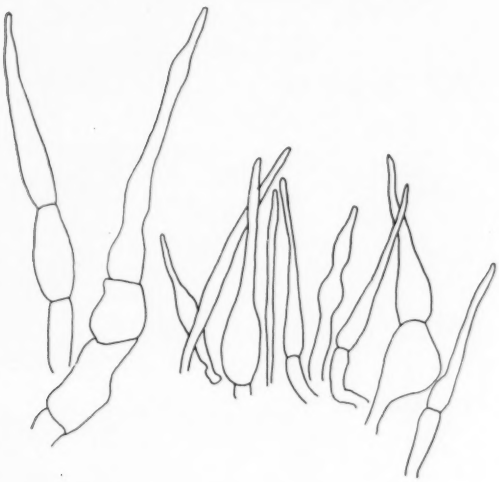
254 - pusilliformis Murr.



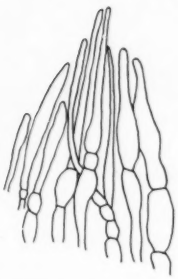
255 - atropurpurea Pk.



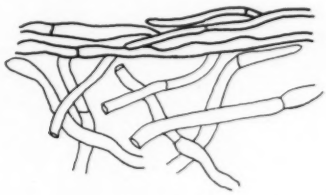
256 - nigrescentipes Pk.



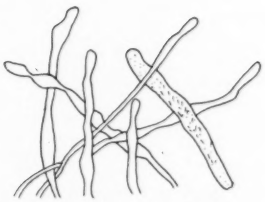
257 - granulosula Murr.



258 - lividirosea Murr.

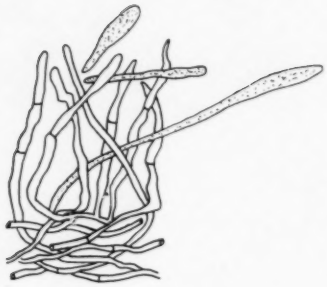


259 - compacta Frost & Pk.

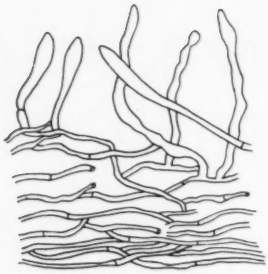


260 - obscuriformis Murr.

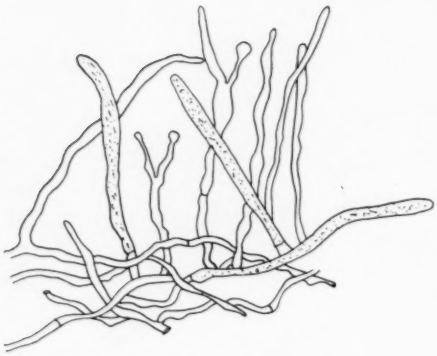
261 - subochrophylla Murr.



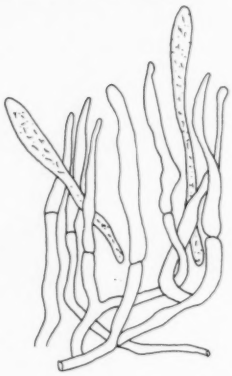
262 - blackfordae Pk.



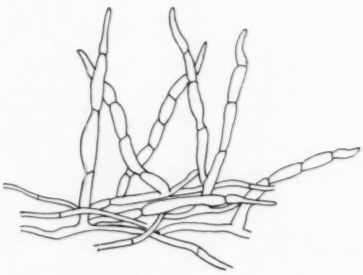
263 - flavida Frost & Pk.



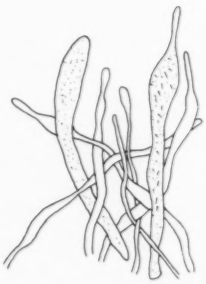
264 - flaviceps Pk.



265 - cinerascens Beards.

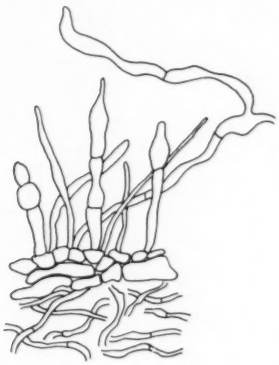


266 - earlei Pk.

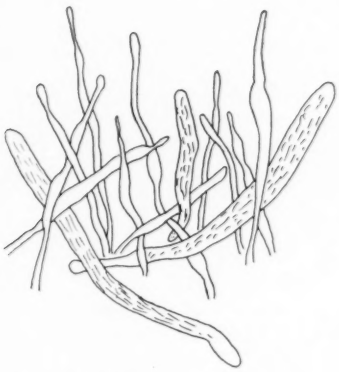


267 - pinicola Murr.

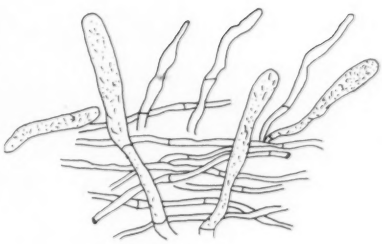
268 - perplexa Burl.



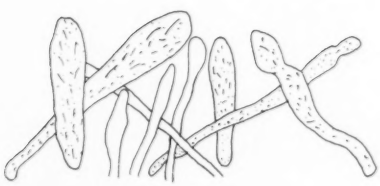
269 - uncialis Pk.



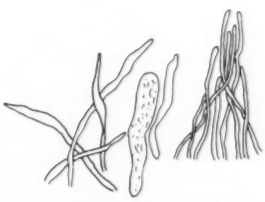
270 - burkei Burl.



271 - admirabilis Beards. & Burl.

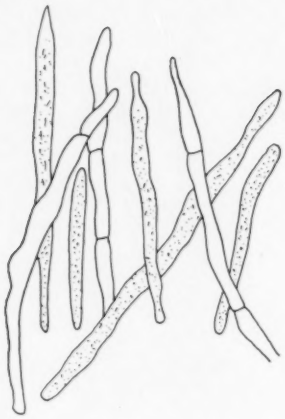


272 - perlactea Murr.

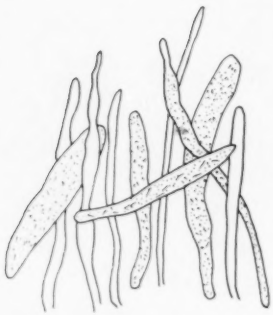


273 - praecompacta Murr.

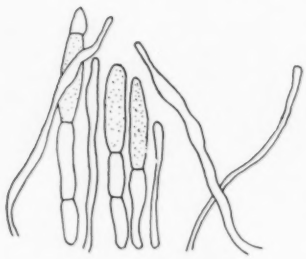
274 - albidula Pk.



275 - leucomodesta Sing.

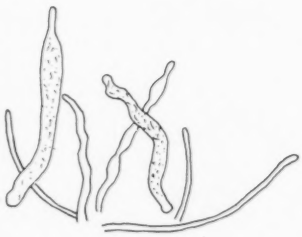


276 - inedulis Murr.



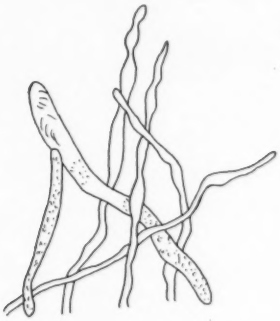
277 - luteispora Murr.

278 - incarnaticeps Murr.

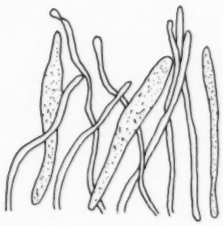


279 - fosteriana Murr.

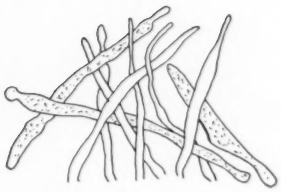
280 - ferrotincta Sing.



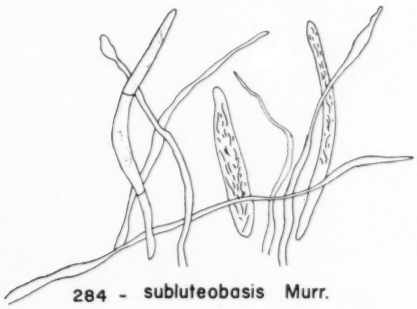
281 - cystidiosa Murr.



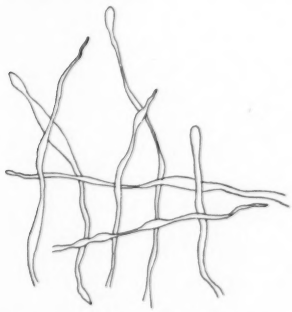
282 - aurantialutea Kauff.



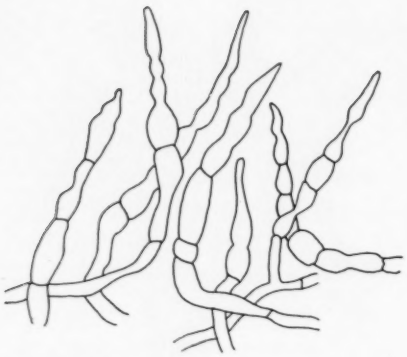
283 - diaboli Sing.



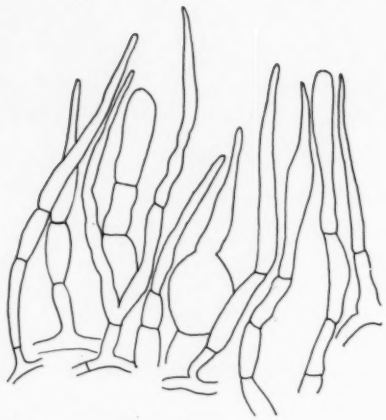
284 - subluteobasis Murr.



285 - cremea (Murr.) Sing.

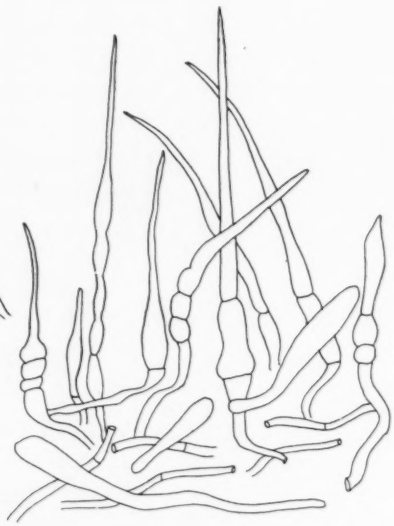


286 - brunneola Burl.

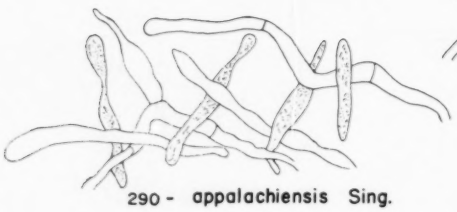


287 - variicolor Murr.

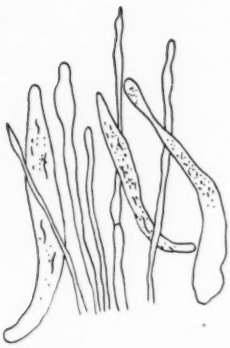
288 - flocculosa Burl.



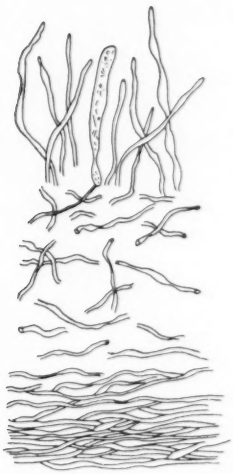
289 - modesta Pk.



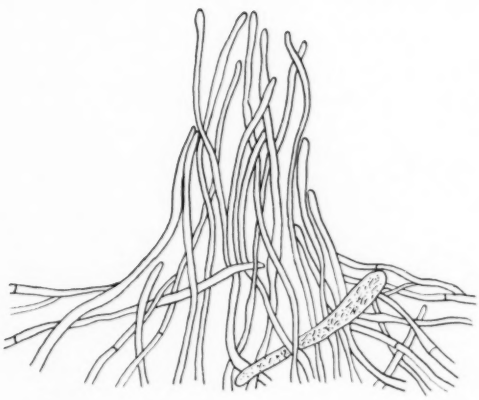
290 - appalachiensis Sing.



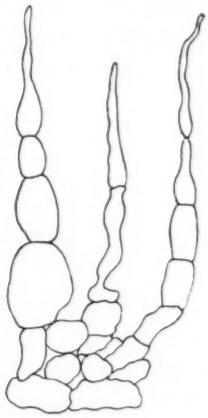
291 - pervirginea Murr.



292 - beardslei Burl.



293 - patriotica Murr.



294 - maculosa Murr.

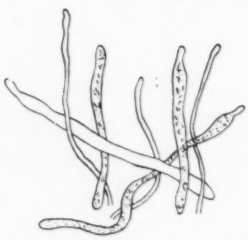
295 - albiflavescens Murr.

296 - arnoldae Murr.

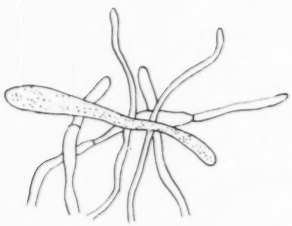
297 - australirosea Murr.

298 - variata Bann.

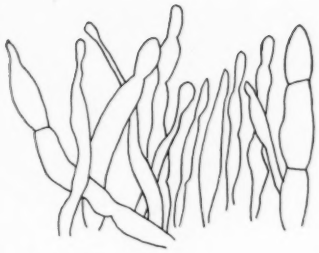
299 - alutaceiformis Murr.



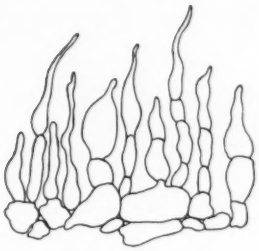
300 - albimarginata Murr.



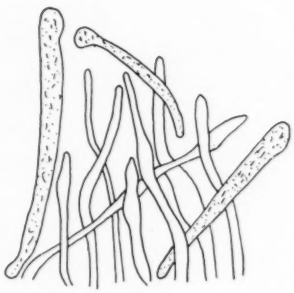
301 - levyana Murr.



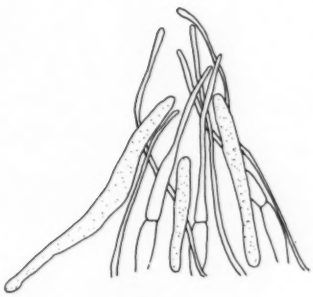
302 - subfloridana Murr.



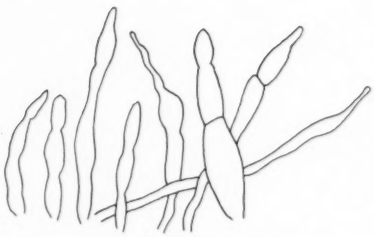
303 - subglauca Murr.



304 - novispora Murr.



305 - xerampelina
var. semirubra Sing.

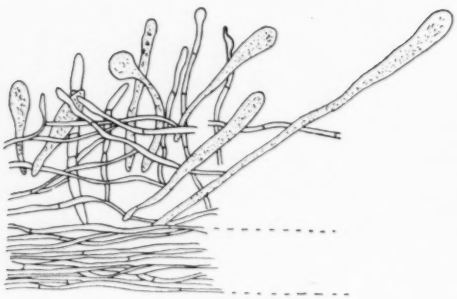


306 - regalis Murr.

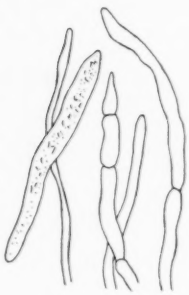
307 - pinetorum Murr.

308 - rosei-isabellina Murr.

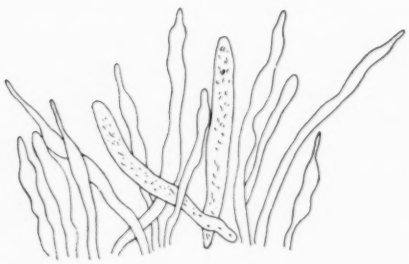
309 - pseudolepida Sing.



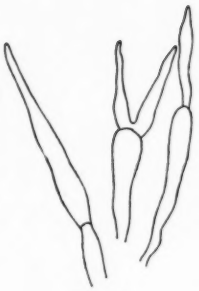
310 - subacris Murr.



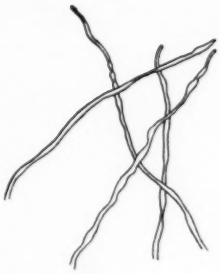
311 - pinophila Murr.



312 - subcremeiceps Murr.

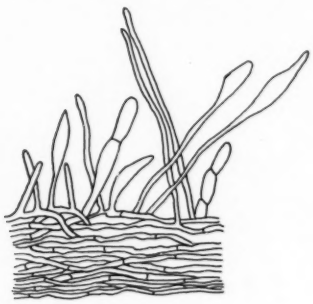


a. rare

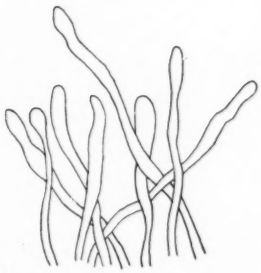


b. common

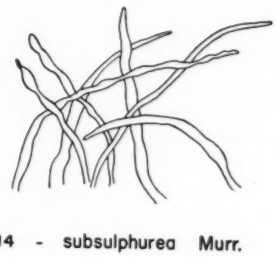
313 - subgraminicolor Murr.



315 - luteobasis Pk.

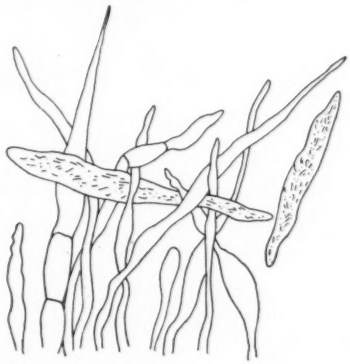


317 - subinconstans Murr.



314 - subsulphurea Murr.

316 - vinosirosea Murr.



318 - basifurcata Pk.

Publications of the Torrey Botanical Club

Available Back Stock

Torrey Botanical Club: Bulletin

Vols. 23–85, 1895–1958. With General Index 1–75. Partly bound. $850.00
Vols. 26–48, 56–66, 72–84. 1899–1957. Unbound. Per volume 12.00

Vol. 26, Nos. 3, 12
Vol. 27, Nos. 7, 8
Vol. 28, Nos. 3–12
Vol. 29, Nos. 2–12
Vol. 31, Nos. 1, 3–12
Vol. 36, Nos. 11, 12
Vol. 38, No. 1
Vol. 40, Nos. 1, 2, 6, 8–10
Vol. 41, Nos. 1, 3–11
Vol. 42, No. 5
Vol. 45, No. 1
Vol. 44, Nos. 1–8
Vol. 47, Nos. 1–3
Vol. 56, Nos. 3–9
Vol. 57, Nos. 4, 5, 7, 9
Vol. 58, Nos. 1–7, 9
Vol. 64, No. 8
Vol. 65, Nos. 2, 4, 6, 8
Vol. 66, Nos. 7–9
Vol. 72, Nos. 4–6
Vol. 73, No. 1
Vol. 74, Nos. 5, 6
Vol. 76, Nos. 5, 6
Vol. 77, Nos. 4–6
Vol. 78, Nos. 3, 4
Vol. 79, Nos. 1–5
Vol. 80, Nos. 1, 3, 5
Vol. 81, No. 2
Vol. 82, No. 5
Vol. 83, Nos. 1, 2, 4, 6
Vol. 84, Nos. 1, 3, 5, 6
Vol. 85, Nos. 1–6

Per no. $2.50
General Index 7–16 10.00

Torrey Botanical Club: Memoirs

Vols. 1–21, No. 1. 1899/90–1958. Unbound. (Lacks Vols. 3, Nos. 1–3–end.) $250.00
Vols. 5–8, Nos. 10–17. Unbound. Per volume 10.00
Vols. 18–20. Unbound. Per volume 15.00

Vol. 1, Nos. 3, 4
Vol. 2, Nos. 2, 4
Vol. 3, No. 2
Vol. 4, No. 3
Vol. 5, No. 1
Vol. 6, Nos. 3–5
Vol. 7, No. 1
Vol. 8, No. 1, pts. 1, 2
Vol. 8, Nos. 2, 3
Vol. 10, No. 1
Vol. 11, No. 1
Vol. 12, Nos. 1, 2
Vol. 13, No. 1
Vol. 14, Nos. 1, 3
Vol. 15, No. 1
Vol. 16, Nos. 1, 3
Vol. 17, No. 1
Vol. 18, No. 1
Vol. 19, Nos. 1–3
Vol. 20, Nos. 1, 2, 4

Per no. $3.00

Torreya: A Monthly Journal of Botanical Notes and News

Vols. 1–45. 1901–1945. Mostly bound. $225.00
Vols. 1–19, 21–24, 26, 30–39, 41–45. Unbound Per volume 6.00

Vol. 1, Nos. 3, 4, 6–12
Vol. 2, Nos. 2–12
Vol. 3, Nos. 1, 3–12
Vol. 4, Nos. 1, 3–12
Vol. 5, Nos. 1, 3, 4, 6–12
Vol. 6, Nos. 1, 2, 5–12
Vol. 7, Nos. 1–7, 9–12
Vol. 8, Nos. 2–12
Vol. 9, Nos. 1–5, 7–12
Vol. 10, Nos. 1, 3–12
Vol. 11, Nos. 1–10, 12
Vol. 12, Nos. 1–7, 9–12
Vol. 13, Nos. 1–6, 8–12
Vol. 14, Nos. 3–12
Vol. 15, Nos. 1–3, 5–8, 10–12
Vol. 16, Nos. 1–3, 5–12
Vol. 17, Nos. 1–3, 10–12
Vol. 18, Nos. 1–6, 8–12
Vol. 19, Nos. 1–10
Vol. 20, Nos. 1, 2, 4–6
Vol. 21, Nos. 3–6
Vol. 22, Nos. 1, 2
Vol. 23, Nos. 3–6
Vol. 24, No. 3
Vol. 27, Nos. 5, 6
Vol. 28, Nos. 4, 6
Vol. 29, Nos. 2–4, 6
Vol. 30, Nos. 2, 4–6
Vol. 31, Nos. 3–6
Vol. 32, Nos. 2–4, 6
Vol. 33, Nos. 2–5
Vol. 34, Nos. 1, 2, 4–6
Vol. 35, Nos. 2–5
Vol. 36, Nos. 3, 4, 6
Vol. 37, Nos. 3, 6
Vol. 38, Nos. 2–6
Vol. 39, Nos. 1, 3, 5, 6
Vol. 40, Nos. 1–6
Vol. 41, Nos. 3–6
Vol. 42, Nos. 3–6
Vol. 43, No. 2
Vol. 44, Nos. 2, 3
Vol. 45, Nos. 2–4

Per no. $2.00

Address orders and inquiries to our agent

WALTER J. JOHNSON, INC.

111 Fifth Avenue, New York 3, N. Y.